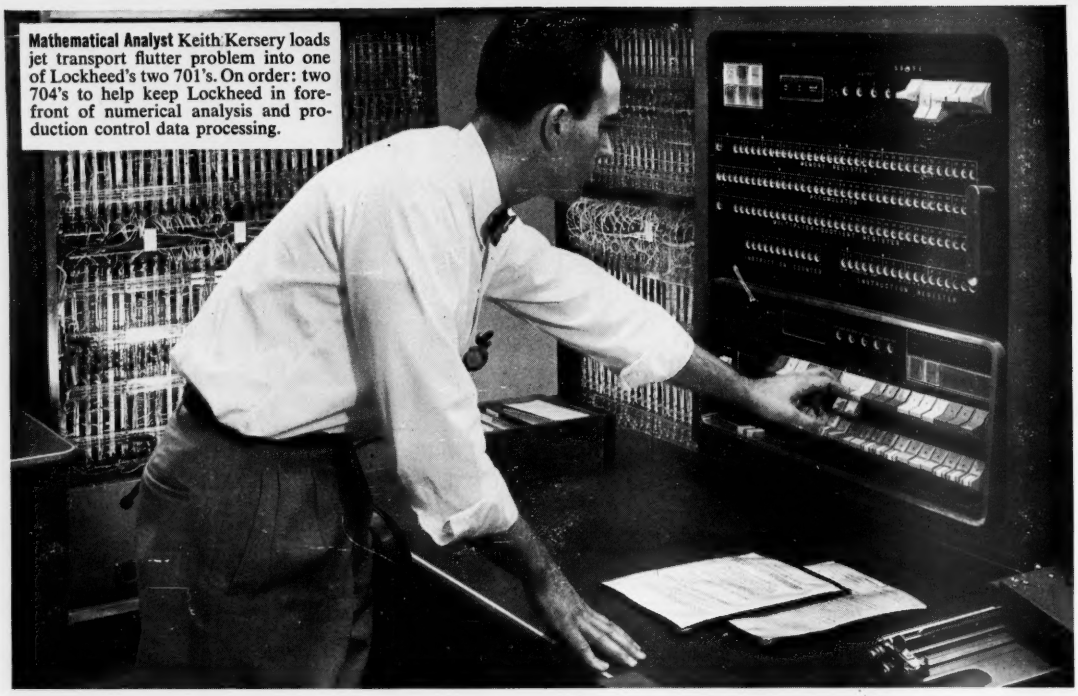
COMPUTERS AND AUTOMATION

CYBERNETICS • ROBOTS • AUTOMATIC CONTROL

Flight Simulators – A New Field
. . . Alfred Pfanstiehl

Robots I Have Known
. . . Isaac Asimov

The Capacity of Computers Not to Think
. . . Irving Rosenthal,
John H. Troll



Mathematical Analyst Keith Kersery loads jet transport flutter problem into one of Lockheed's two 701's. On order: two 704's to help keep Lockheed in forefront of numerical analysis and production control data processing.

New 701's speed Lockheed research in numerical analysis

The first airframe manufacturer to order and receive a 701 digital computer, Lockheed has now received a second 701 to handle a constantly increasing computing work load. It gives Lockheed the largest installation of digital computing machines in private industry.

Most of the work in process is classified. However, two significant features to the career-minded Mathematical Analyst are: 1) the wide variety of assignments caused by Lockheed's diversification and 2) the advanced nature of the work, which consists mainly of developing new approaches to aeronautical problems.

Career Opportunities for Mathematical Analysts

Lockheed's expanding development program in nuclear energy, turbo-prop and jet transports, radar search planes, supersonic aircraft and other classified projects has created a number of openings for Mathematical Analysts to work on the 701's.

Lockheed offers you attractive salaries; generous travel and moving allowances; an opportunity to enjoy Southern California life; and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary in the form of insurance, retirement pension, sick leave with pay, etc.

Those interested are invited to write E. W. Des Lauriers for a brochure describing life and work at Lockheed and an application form.

LOCKHEED AIRCRAFT CORPORATION
BURBANK **CALIFORNIA**

COMPUTERS AND AUTOMATION

CYBERNETICS • ROBOTS • AUTOMATIC CONTROL

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THE EDITOR'S NOTES

Meetings.

October 4-6, Mon. to Wed., National Electronics Conference and Exhibition, Hotel Sherman, Chicago, Ill. Session 15 on October 5 is on computers.

October 21-22, Thurs. - Fri., Institute of Management Sciences, first annual meeting, Webster Hall Hotel, Pittsburgh, Pa. For more information write to Mr. Robert Johnson, 3500 Grant Bldg,, Pittsburgh 30, Pa.

Oct. 25-27, Mon. to Wed., Systems and Procedures Association of America, Hotel Commodore, New York, N.Y. Several sessions will be devoted to electronic equipment for handling information.

Nov. 21-22, Sun., Mon., Automatic Control Equipment Exhibition, Waldorf Astoria Hotel, New York, N.Y.

Nov. 29-Dec. 2, Mon. - Thurs., First International Automation Exhibition, 244th Regiment Armory, 122 West 14 St., New York, N. Y.

Dec. 8-10, Wed. - Fri., Eastern Joint Computer Conference and Exhibition, Bellevue-Stratford Hotel, Philadelphia, Pa. Meeting entirely devoted to the theme of "The Design and Application of Small Digital Computers".

Address Changes. If your address changes, please notify us giving both old and new addresses, and allow three weeks for the change.

Back Copies. See the information on page 30.

Manuscripts. We are interested in articles and papers. To be considered for any particular issue, the manuscript should be in our hands by the 5th of the preceding month.

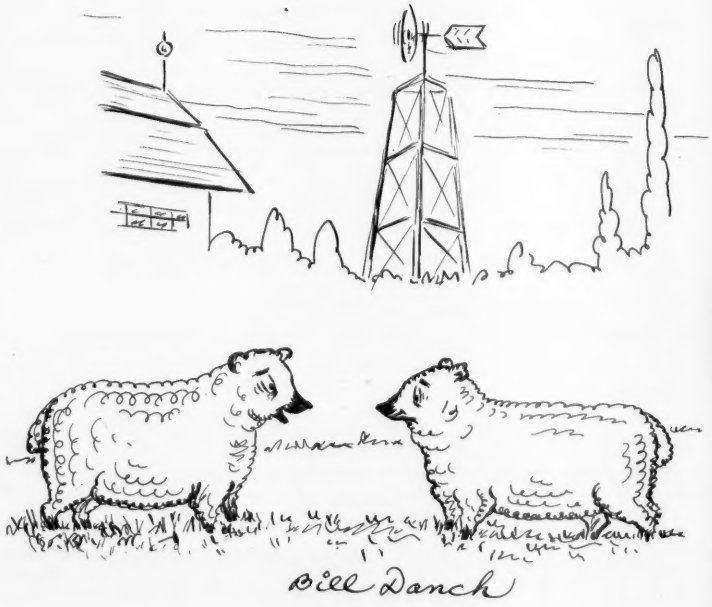
Articles. We desire to publish articles that are factual, useful, understandable, and interesting to many kinds of people engaged in one part or another of the field of computers and automation. In this audience are many people who have expert knowledge of some part of the field, but who are laymen in other parts of it. Consequently a writer should seek to explain his subject, and show its context and significance. He should define unfamiliar terms, or use them in a way that makes their meaning unmistakable. He should identify unfamiliar persons with a few words. He should use examples, details, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions. We look particularly for articles that explore ideas in the field of computers and automation, and their applications and implications. An article may certainly be controversial if the subject is discussed reasonably. Ordinarily, the length should be 1000 to 4000 words, and payment will be $10 to $50 on publication. A suggestion for an article should be submitted to us before too much work is done.

Technical Papers. Many of the foregoing requirements for articles do not necessarily apply to technical papers. Undefined technical terms, unfamiliar assumptions, mathematics, circuit diagrams, etc., may be entirely appropriate. Topics interesting probably to only a few people are acceptable. No payment will be made for papers. If a manuscript is borderline, it may be returned to the author to be modified to become definitely either an article or a paper.

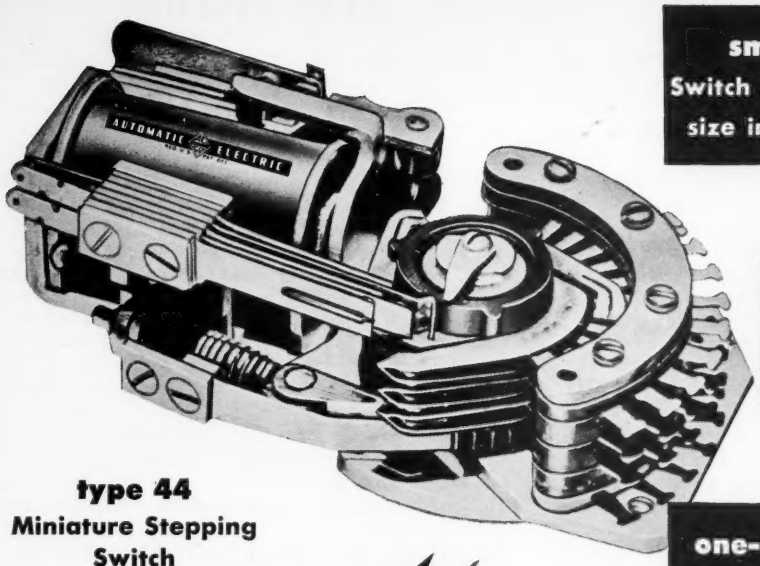
Forum

SOME NOTES ON COUNTING

Bill Danch, Woodstock, N. Y.



"I wish those sleepless people who count us would speed it up with automatic computers!"

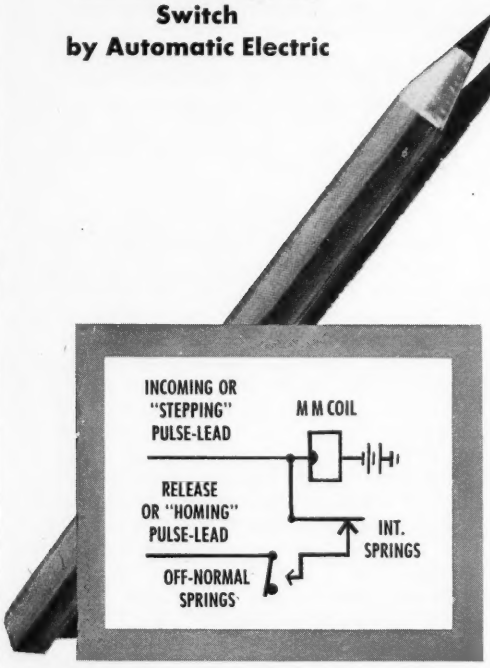


small size
Switch shown actual size in illustration

indirect drive design
For faster stepping and longer life

one-coil design
Cuts costs; separate circuit for "homing"

type 44
Miniature Stepping Switch
by Automatic Electric



How separate "homing" circuit is provided with one-coil operation

Interrupter contact springs open coil circuit near the end of each armature operation—causing switch to step by self-interruption, or by "door buzzer" action.

"Off-normal" contact springs close "homing" circuit on first step of wipers off home position and remain closed until home position is again reached. Thus, after the first step, a "homing" circuit is prepared, and the switch may be "homed" by simply energizing this circuit.

How to make a good product better...without increasing costs

Design engineers everywhere are choosing Automatic Electric's Type 44 Miniature Stepping Switch to insure long service life—often *reducing* costs as they do so! In countless applications, this sturdy switch has operated for more than 200 million operations, with little or no adjustment. The one-coil design eliminates a separate release coil—a saving passed on to the user.

And there are other reasons for such widespread approval: weight and space are saved; indirect drive design give smooth stepping and because there's no wiper "double loading" there's no "galloping"; the unique driving mechanism permits extremely high operating speeds.

Investigate Automatic Electric's Type 44 Switch for your control applications. Here's the first compact, lightweight switch to provide 10-, 20- or 30-point operations. Designed for any dc voltage up to 110, or, with an associated rectifier, for 115 volts 60 cycle ac. For more details on this and other Automatic Electric stepping switches, write for helpful engineering specifications to: Automatic Electric Sales Corporation, 1033 West Van Buren Street, Chicago 7, Illinois. In Canada: Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

RELAYS **SWITCHES**

PRODUCTS OF THE INDUSTRIAL DEPARTMENT OF

AUTOMATIC ELECTRIC

CHICAGO

FLIGHT SIMULATORS - A NEW FIELD

Alfred Pfanstiehl, Field Consultant
Engineering & Research Corp., Riverdale, Md.

Ground-bound instrument flight trainers have been around a good many years, helping pilots learn or sharpen up their navigation and instrument flying techniques, including radio aids to navigation and GCA (Ground Control Approach) landings. It's no trick at all to get lost, burn up all your fuel, and even to spin in while "flying" one of these early Link (mostly mechanical) or Curtiss-Wright Dehmel (electronic) instrument trainers. The sweat you work up while trying to find your way "home" is very real, perhaps born of a subconscious realization that you had better learn these techniques -- the next time will be for real. Yet while an instrument trainer has a full quota of flight instruments, stick, rudder pedals, throttle, etc., it appears and handles like no actual plane: you have to learn to "fly" it first, just like any aircraft new to you.

Instrument trainers have grown up in the last few years. The Air Force and large airlines now have "Flight Simulators", also called "OFT'S" (Operational Flight Trainers) by the Navy, which apparently was the first to recognize the value of complete simulation. Now complete crews of all types of large transport planes and bombers, as well as the pilots of the single-seat F-86D Radar Interceptor and the pilot and radar observer team of other all-weather interceptors, can practice complete missions, take-off thru landing, of the planes they will actually fly later. From perfectly duplicated cockpits and crew stations they get the whole story, with emergency procedures as one of the most important factors and one the flyers appreciate the most. A simulated emergency such as a jet engine "flame-out" can actually be more realistic than any real aircraft emergency procedure practice a pilot or instructor would dare undertake.

Hundreds of these simulators are right now grinding out hours of flight training at a tremendous saving in money and time. Every new type aircraft put into production has its shadow — a simulator -- designed and put in production at the same time. And in at least one case, that of the F-86D, its simulator (built and designed by Engineering and Research Corp.) was installed and training pilots before the aircraft itself was delivered.

Find some aerodynamic engineers who also know electronics and analog computers, and put them to work on the available design and flight test data of the plane you want to simulate. This data is usually quite incomplete, for our purpose, anyway, and there are also many practical limits on size and cost of the simulator. This means that they must make many wise assumptions and simplifications as they work. Their efforts result in sets of equations with numerical coefficients which you hope will reasonably describe the actions of the plane on the ground, in unlimited flight, and in stall.

Now let the computer engineers go to work mapping out block diagrams, figuring analog scaling factors, calculating values for thousands of precision resistors used for input and feedback circuits of summing amplifiers, motor amplifiers, etc., and generally solving what look at first like impossible situations. (What do you do when the plane flies straight up so that the tangent of the pitch angle becomes infinite -- let an infinite voltage represent this? What happens to heading when performing a roll straight up? How about diving thru the sound barrier?)

At this stage the job is just beginning. Dozens of special "pin ball" circuits must be designed, each electronic chassis must go thru many stages before final okay, the insides of the cockpit instruments must be redesigned to accommodate synchros, basic problems of stability must be solved, and all the bugs in the first bread-board computers must be tracked down. Cabling and structural design alone require thousands of man-hours. Finally, a prototype which works pretty well is completed so that you can go over the whole thing and get started on redesign for a production model, following changes in specifications which have occurred meanwhile in the original aircraft, and improving on the "feel" of your simulator so that the pilots who check them out are satisfied.

The electrical and mechanical paths between the pilot's controls and the flight, engine, navigation aids, and radar instruments he reads, is a long and involved one. The heart of any simulator lies in the computers which keep track of linear changes along and angular changes around the aircraft's three axes. Thus, six interdependent rate equations are solved continuously and simultaneously. They are based on Newton's Law, $a = f/m$, with corrections introduced to take care of the complete and unambiguous method of defining changes in aircraft attitude and motions. This method involves a

correct order of statement as well as transformations between earth-fixed, aircraft-fixed, and "relative wind" axes. To see this latter problem, pick up a toy airplane and rotate it thru 90° each of roll to the right (around the logitudinal, or x axis), pitch up (around the lateral, or y axis), and then yaw or turn to the right (around the normal, or z axis). Note the final position of the plane; now repeat each movement, but in a different order such as pitch, roll, then yaw. Where do you end up this time? That's the problem; for its solution, look up "Euler Angles" in any aerodynamic text.

The six simultaneous "answers" from the Rates Computer portion of a simulator, then, appear as degrees of rotation of the six rates (integrator) shafts which turn precision potentiometers to give relative voltages representing these rates.

Coming before the Rates Computer is the Aerodynamics Computer, which figures the forces and moments arising from the deflections of the control surfaces and dynamic pressures, not to mention the drag terms due to wheels, flaps, ice, etc. Following the Rates Computer are the distance and altitude plotting boards and the Euler Angle Computer, which integrate rates to get distances and specific roll, pitch, and yaw angles. These shaft positions and signals feed the other computers and the pilot's artifical horizon and other flight instruments, most of which have non-linear scales that must be matched, using non-linear feedback servoes.

Even such relatively unimportant items as the stand-by compass magnetic turn errors and swinging associated with acceleration "g's" must be worked out; it's these corner-of-the-eye little clues which make simulators so vividly realistic. Pilots sometimes swear they even feel "g" forces on their bodies, although that's the one thing not actually simulated; the other clues tell him they should be there, and his mind fills the gap.

It is planned that the next article on this subject will give examples of some of the interconnecting chains of events between the pilot's movements of his controls and the final instrumentation. However, a brief technical description now of some of the analog computer elements involved might be in order.

Summing Amplifier: High quality, high gain, power amplifier with frequency response designed to fall off faster than the phase shift so that with even 100% negative feedback there can be no oscillation at higher frequencies where phase shift might turn negative feedback into positive. Plus and minus quantities to be summed are represented by 0° and 180° phase AC signals. The centertapped secondary of the output transformer enables either phase of the summed output to be used; input and feedback precision resistors (high impedance) determine the transfer ratios of each of the one or more inputs to the output signal. The Summing Amp does not load the potentiometers supplying the input signals and its power output is capable of supplying a number of low impedance potentiometers used in multiplying and dividing circuits.

Motor Amplifier: High gain power amplifier with zero phase shift at operating frequency (60 or 400 cy/sec) to supply one phase of the reversible two-phase motors used to drive the "shafts".

Shaft: General term used for a mechanical assembly consisting of a motor-generator, slip clutch, gear box, precision potentiometers, cams and microswitches, resolvers, synchros, etc. Sometimes have sections interconnected with differential gears.

Motor-generator: Two phase motor (direction and speed depend on phase and magnitude of drive signal to one phase relative to the reference phase) directly connected to a drag-cup type generator. This "generator" is really a transformer, with output phase and magnitude dependent on direction and speed of rotation; frequency is constant, as supplied to its field coil. These motor-generators can be stalled without harm.

Precision Pot: Potentiometer constructed with excellent linearity, low torque, unlimited mechanical rotation (but usually 320° of useful electrical rotation), and arranged for simple coupling in stacks. Often contain many taps so that non-linear functions can be duplicated by using external padding resistors.

Resolver: Armature transformer giving an output proportional to the input times the sine or cosine of the shaft angular position. A universal resolver has a pair of stators at 90° and a pair of rotors also at 90° to each other.

Synchro: Also called autosyn, selsyn, etc.; three-coil stator (120° apart) and single coil rotor, used as transmitters and receivers for angular position remote indicators and other applications. Differential Synchro is a special type with three-coil rotor, used to introduce additional angular data between the transmitter and motor of a regular synchro hook-up.

Selector: When no shaft is present which servoes to positions representing particular quantities, and therefore there is no chance to have a cam and microswitch to operate relays

at specific values, an electronic phase-sensitive selector circuit may be used for this purpose, operating directly from the AC signals representing the quantity.

Servo (Position): Motor amp and shaft arranged so that the geared-down output of the shaft turns to specific positions dependent on the phase (0^0 or 180^0) and magnitude of the input signal. The motor runs until the input signal is cancelled by an opposite phase signal from a feedback pot on the shaft. Stabilized and damped by negative feedback from the generator on the motor-generator driving the shaft, which reduces to zero as the final position is approached. This allows for "tight" servo action, as effective gain is maximum (no generator feedback to reduce input signal) at zero velocity of the shaft.

Integrator (Rate Servo): Motor amp and shaft with no feedback pot so that the rate and direction of turning depends upon the magnitude and phase of the input signal. Rate of integration is determined by the amount of negative (damping) feedback used from the generator back to the motor amp.

A simulator, then, consists of literally tons of this sort of equipment, special electronic chassis, power supplies, DC and 400 cycle AC motor generators (big ones), miles of wire, plus the precisely simulated cockpit and crew stations. Day-night, cloud and sound effects, and even rough air effects are included. Besides the many racks containing the computing equipment, there is an instructor's console room with its duplicate instrumentation, automatic plotting boards which draw lines to follow the "aircraft's" track, and an array of controls permitting training in all phases of navigation, emergencies, and in some cases, use of the newest lock-on airborne radar of the all-weather interceptors, special sub detection equipment for ASW (antisubmarine warfare) patrol planes, or even visual air-to-air gunnery training.

The computers in flight simulators are bulky, at present, to enable adequate precision, on the order of 1%, and because miniaturization is both expensive and not really necessary. Maintenance problems are often quite involved, perhaps because these computers are not cases of massive repetition. It is difficult to appreciate the extent of the control loops and interdependencies necessary to accommodate enough of the aerodynamic subtleties for good "flying". Adding rough air effects becomes quite a problem, and of course wing as well as pitot ice is fully simulated. To keep pitching rates realistic, many simulators even keep track of the changing center of gravity as fuel and armament stores are used up. In the case of jets, Mach number speed is the most important aerodynamically, and is, of course, dependent upon relative forward (x axis) velocity and a function of altitude. Indicated airspeed is another function, while the actual ground speed, as integrated on the plotting boards, is still another — yet all are forward velocities which depend on many factors. The instructor may set in barometric readings, wind velocities, and landing field elevations.

A "crash" circuit freezes all instruments and rings a bell, removing all sound simulation, whenever the pilot pulls too many "g's" or reaches zero absolute altitude with too great a rate of descent, wheels up, or with too much pitch or roll.

It even becomes a pretty problem to design the simulator so it won't appear to fly underground, although this doesn't look difficult at first. You can bounce on landing, spin, and stall.

These factors are only a few of the problems involved, of course; the engine simulation with all its "pin ball" circuits, the complete radio navigation aids and communication circuits, the air and engine sound simulation (including "ground reverberation", ram air, wheel screetch, and flame-out explosion) are a few more. The student is so close to the real thing that he easily forgets the ground is a couple of feet below him all the time. Student pilots wear their full flying gear when training in simulators, for the final clues to the real thing.

The record of flight simulators so far has been impressive, with a number of "saves" to their credit, chalked up to the automatic correct responses to emergencies that pilots gain. Combining electronics, computers, aerodynamics, and mechanics, this is now a new and quite significant professional field, with plenty of interesting and varied problems yet to be solved or refined. Engineers and young men completing college would do well to consider it. The manufacturers point out that while flight simulators may not be the largest analog computers in the world, they are among the most complex and they <u>are</u> the largest computers of any sort really made in quantity. There's lots to them and lots of them!

- END -

Roster of Organizations in the Field of Computers and Automation

(Supplement, information as of September 3, 1954)

The purpose of this Roster is to report organizations (all that are known to us) making or developing computing machinery, or systems, or data-handling equipment, or equipment for automatic control and materials handling. In addition, some organizations making components may be included in some issues of the Roster. Each Roster entry when it becomes complete contains: name of the organization, its address and telephone number, nature of its interest in the field, kinds of activity it engages in, main products in the field, approximate number of employees, year established, and a few comments and current news items. When we do not have complete information, we put down what we have.

We seek to make this Roster as useful and informative as possible, and plan to keep it up to date in each issue. We shall be grateful for any more information, or additions or corrections that any reader is able to send us.

Although we have tried to make the Roster complete and accurate, we assume no liability for any statements expressed or implied.

This listing is a supplement to the cumulative listing in the April issue of "Computers and Automation", vol. 3, no. 4 and the supplements in the May issue, vol. 3, no. 5, the July issue, vol. 3, no. 6, the September issue, vol. 3, no. 7, and contains additions or corrections as compared with previous listings.

Abbreviations

The key to the abbreviations follows:

Size
- Ls Large size, over 500 employees
- Ms Medium size, 50 to 500 employees
- Ss Small size, under 50 employees (no. in parentheses is approx. no. of employees)

When Established
- Le Long established organization (1922 or earlier)
- Me Organization established a "medium" time ago (1923 to 1941)
- Se Organization established a short time ago (1942 or later) (no. in parentheses is year of establishment)

Interest in Computers and Automation
- Dc Digital computing machinery
- Ac Analog computing machinery
- Ic Incidental interests in computing machinery
- Sc Servomechanisms
- Cc Automatic control machinery
- Mc Automatic materials handling machinery

Activities
- Ma Manufacturing activity
- Sa Selling activity
- Ra Research and development
- Ca Consulting
- Ga Government activity
- Pa Problem-solving
- Ba Buying activity

  (Used also in combinations, as in RMSa "research, manufacturing and selling activity")

*C This organization has kindly furnished us with information expressly for the purposes of the Roster and therefore our report is likely to be more complete and accurate than otherwise might be the case. (C for Checking)

ROSTER

Advance Electronics Co., Inc., 451 Highland Ave., Passaic, N. J. / Prescott 8-3687 / *C
Electronic instruments. Ss(20) Se(1952) Ic Ma

Aero Research Instrument Co., Inc., 1901 N. Hermitage Ave., Chicago 22, Ill. / Capitol 7-5600/ *C Ss Se RMSa

Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa. / Harrisburg 4-0101 / *C
Patchcord programming systems, patchcords, automatic wire terminators. Ls(1600) Me (1941) Ic RMSa

Alden Electronic and Impulse Recording Equipment Co., Alden Research Center, Westboro, Mass. / Westboro 467 / *C
Facsimile recording equipment and facsimile components; "On-the-Spot Fact Finders", pulse records, automatic curve plotters. Recorder that monitors any machine or action and records automatically. Ms(450?) Se Ic RMSa

Alfax Paper and Engineering Co., Alden Research Center, Westboro, Mass. / Westboro 467 / *C
Electrosensitive recording papers. Ms Se (1942) Ic AMSa

R. C. Allen Business Machines, Inc., 678 Front Ave., Grand Rapids 4, Mich. / Glendale 6-8541/ *C
Adding machines, bookkeeping machines, cash registers, etc. Ls(1250) Me(1932) DIc RMSa

American Machine and Foundry, Electronics Division, 1085 Commonwealth Ave., Boston, Mass. / Algonquin 4-4234 / *C
Magnetic shift registers, digital data handling equipment; servomechanisms to specifications. Digital servo with 2^{15} quantum units per revolution (shaft to digital conversion). Ls(900) Se(1948) Dc RMSa

American Relay and Controls, Inc., 3621 Howard St., Skokie, Ill. / Orchard 5-2600 / *C
Relays. Ms(60?) Se(1947) Ic RMSa

Amperite Co., Inc., 561 Broadway, New York 12,

N.Y./Canal 6-1446 / *C
Delay relays and regulators for computers, &c. Ms(75) Me(1923) Ic RMSa

Ampex Electric Corp., 934 Charter St., Redwood City, Calif. / Emerson 8-1471 / *C
Magnetic recording of data. Ls(550) Se(1944) Ic RMSa

Andersen Laboratories, Inc., 39-C Talcott Road, West Hartford 10, Conn. / Adams 3-4491 / *C
Solid ultrasonic delay lines, computer memories, &c. for computer applications. Ss(30) Se(1950) Ic RMSa

Argonne National Laboratory, Box 299, Lemont, Ill./ Bishop 2-2750, Lemont 800 / *C
Production of big electronic automatic digital computers for use of Atomic Energy Commission only. ?s Se Dc RMa

Armour Research Foundation, Illinois Inst. of Technology, 10 West 35 St., Chicago 16, Ill. / Calumet 5-9600 / *C
Magnetic recording. Digital, analog, and data-handling equipment. Automatic control machinery. Servomechanisms. Instrumentation. Ls(1200) Me(1936) DASCc RCPa

Askania Regulator Co., 240 E. Ontario St., Chicago, Ill. / Whitehall 4-3700 / *C
Hydraulic and electronic automatic control equipment. Use analog computers; manufacture servomechanisms and automatic controls. Ms (400) Me(1930) SCc RMSPa

Audio Instrument Co., Inc., 133 West 14 St., New York 11, N. Y, / Oregon 5-7820 / *C
Electronic, mechanical, and optical analog computers. Precision electronic instruments. Time-delay units from 10 to 10,000 milliseconds. Fire control equipment, logarithmic amplifiers. Specialized passive computer which corrects for film nonlinearity in photometric work, &c. Ss(10) Se(1949) DASCc RMSCa

The Austin Co., Special Devices Div., 76 9th Ave., New York 11, N. Y. / Watkins 4-3630 / *C
Systems and devices for automatic control in commerce and industry; analog, digital, data-handling, servo, electronic, electromechanical. Shaft position indicators and systems; cathode ray indicators and systems. Ls(division, 125; company 25,000) Le(division, 1943; company 1878) DASCMc RMSa

Avion Instrument Corp., Division of American Car and Foundry Industries, Inc., 299 State Highway No. 17, Paramus, N. J. / Oradell 8-4100 / *C
Digital and analog computing machinery. Magnetic recorders, amplifiers, electronic choppers, test equipment, servomechanisms, automatic control machinery, &c. Ms(160) Se (1946) DASCMc RMSCPa

Baird Associates, 33 University Road, Cambridge 38, Mass. / University 4-0101 / *C
Spectroscopic analysis equipment; scientific instruments; analog devices, servomechanisms; transistors. Instrumentation for industrial control. Research in physical optics. Ms (200) Me(1937) AISc RMSa

Bell Telephone Laboratories, Murray Hill, N. J. / Summit 6-6000 / and 463 West St., New York 14, N. Y. / Chelsea 3-1000 / *C
Automatic switching. Bell general purpose computers (relay and electronic, digital and analog) for government use and company's own use. Ls Le DAc RGPa

Benson-Lehner Corp., 2340 Sawtelle Blvd., West Los Angeles 64, Calif. / AR-93723, BR-21197 / *C
Automatic and semi-automatic devices (both analog and digital) for computing, data analyzing, data reduction, optical measuring, guided missile analysis, &c. Oscillogram trace readers, plotters, &c. Commercial applications of industrial control devices. Ms(118) Se(1950) DAc RCMSa

Berkshire Laboratories, 732 Beaver Pond Road, Lincoln, Mass. / Waltham 5-7000 / *C
Special computer components. Ss Se(1949) IAc RMCa

Birkbeck College, University of London, 21 Torrington Sq., London W.C. 1, England / Langham 1912 / *C
Maker of ARC, APEXC, and SEC digital computers; electronic digital computers. Ss(10 to 20) Se(1946) Dc RCPa

Boeing Airplane Company, Industrial Products Division, Seattle 14, Wash. / Mohawk 4444 / *C
Boeing Electronic Analog Computer. Associated non-linear equipment. Complete line of auxiliary equipment, including function generator and electronic multiplier. Ls (37,000) Le(1916) Ac RMSa

Bradley Laboratories, Inc., 168 Columbus Ave., New Haven, Conn. / Main 4-3123 / *C
Selenium rectifier kits, high temperature rectifiers. Ms Me Ic RMSa

British Tabulating Machine Co., Ltd., 17 Park Lane, London W. 1, England. / Hyde Park 8155 / *C
Punched card machines. Ls(4500) Le(1908) Dc RCPMSa

Bureau of the Census, Washington 25, D. C. / *C
Tabulation of statistical data by special machines designed and built for own use, by commercial punch-card equipment, and by electronic computing system (the Univac). Ls (1100 in Machine Tabulation Division) Le (1890 in punch card field) Dc Ga

Cambridge Thermionic Corporation, 445 Concord Av., Cambridge 38, Mass. / Trowbridge 6-2800 / *C
Components for computers. Ms(150) Me(1940) Ic RMSCa

Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Calif. / Sycamore 6-0173 / *C
Digital and analog data-handling and conversion systems (Sadic, Millisadic, &c.). Automatic translator magnetic tape to punched card. Computers now manufactured by their affiliate, Electro Data Corp., which see. Ls(1400) Me(1937) Dc RMSa

Convair, a Division of General Dynamics Corp., General Offices: San Diego 12, Calif. /Cypress 6-6611 / *C
Research and development in the missile, electronics, and airframe fields. The Charactron, a computer output device for "debugging", tactical display, &c., converting coded information into tabular or graphic alphanumeric information on a cathode-ray tube screen. Digital automatic control; analog to digital conversion units. Large analog computer installations. Ls(44,000) Me(1923) Ic DAIc RMSa

Cook Research Laboratories, Division of Cook El-

ectric Co., 2700 Southport Ave., Chicago 14, Ill. (mail address), 8100 Monticello Ave., Skokie, Ill. (location) / Keystone 9-2060 and Orchard 3-9200 / *C

Magnetic data-recording systems; digital, analog, and hybrid information-processing systems — particularly for aircraft and airborne applications. Basic and industrial research in servomechanisms, air research, weather reconnaissance, guided missiles, &c. Ms(380) ?e DAIc RCa

The Daven Company, 191 Central Ave., Newark 4, N. J. / Mitchell 2-6555 / *C

Precision resistors, rotary switches and attenuators. Ms(490) Me(1929) Ic RMSa

Doelcam Corp., 1400 Soldiers Field Rd., Boston 35, Mass. / Algonquin 4-5200 /

Servomechanisms, amplifiers, &c. Ls(800?) Me SIc RMSa

Electronic Control Systems, Inc., 2138 Westwood Blvd., Los Angeles 25, Calif. / Arizona 7-0244/ *C

Special purpose computers for military and industrial use; industrial process and machine control systems; automatic test equipment. Ss(20) Se(1953) DASCc RMCSa

Electro-Data Corporation, 717 North Lake Ave., Pasadena 6, Calif. / Sycamore 8-6761, Ryan 1-8335 / *C

Automatic electronic digital computers. Electronic data-processing equipment for scientific, industrial and commercial applications. Affiliate of Consolidated Engineering Corp., which see. Ms(150) Se(1950) Dc RMSPa

Elliott Addressing Machine Co., 143 Albany St., Cambridge 39, Mass. / Trowbridge 6-2020 / *C

Addressing stencils, with selection controlled by punched holes in cardboard margin. Ls (1000) Le(1900) Ic RMSa

Elliott Bros. (London) Ltd., Century-Works, Lewisham, London, S.E. 13, England, and Computing Machine Division, Elstree Way, Borehamwood, Herts., England / Tideway 3232, Elstree 2040 / *C

Digital and analog computers; servomechanisms; components, instrumentation and control for process industries. Ls(3500) Le (1800) DASCc RMSCPa

Engineering Research Associates, Div. of Remington Rand, Inc., 1902 Minnehaha Ave., St. Paul, Minn., and 510 18th St. South, Arlington, Va. / Nestor 9601, St. Paul / *C

Automatic digital computers; ERA 1101, 1102, 1103 electronic digital computers; Speed Tally; CAA Flight Plan Storage System; the Logistics Computer. Magnetic storage systems; including magnetic heads, magnetic drums, &c. Shaft-position indicator systems, self-recording accelerometers, analog magnetic recording systems, data-handling equipment, special purpose communications equipment, pulse transformers. Ls(1050) Se(1946) Dc RMCPSa Also see Remington Rand, Inc.

Engineers Northwest, 2835 Nicollet Ave., Minneapolis 8, Minn. / Re 5541 / *C

Test-scoring machines and equipment. Ss(20) Se(1945) DAc RCMa

Epsco, Inc., 126 Massachusetts Ave., Boston, Mass./ Kenmore 6-0601 /

Magnetic shift registers, transistors, delay lines, and other components for computers, systems, automatic control, &c. Ss(20) Se (1954) DIc RMSCa

E-Z Sort Systems, Ltd., 45 Second St., San Francisco 5, Calif. / Garfield 1-8005 / *C

Edge-punched cards for filing and sorting data. Special cards for correlation offacts. Ms(267) Me(1935) Ic RMSa

Federal Telephone and Radio Co., 100 Kingsley Rd., Clifton, N. J. / Nutley 2-3600 / *C

A division of IT&T. Vacuum tubes, selenium rectifiers, germanium diodes, contact protectors, coaxial cables, magnetic amplifiers; radio and telephone systems, microwave systems, and associated components. Ls(6500) Me(1941) ISCc RMSPa

Felt and Tarrant Mfg. Co., Comptometer Div., 1735 No. Paulina St., Chicago 22, Ill. / Brunswick 8-5000 / *C

Adding-calculating machines, key-driven, electric and non-electric. Comptometer. Electronic dictating machines. Ls(1700) Le(1886) Dc RMSa

Fischer and Porter Company, 330 Warminster Road, Hatboro, Pa. / Osborne 5-6000 / *C

Automatic instrumentation, including: measurement of a variable at the point of process; transmission of data, central collection, and display; data reduction systems using a mechanical digital converter (Digi-Coder); tabulated digital data output, &c. Automatic multiple readout systems, converters, computers. Ls(850) Me(1937) DACc RMSa

Friden Calculating Machine Co. Inc., San Leandro, Calif. / *C

Desk calculating machines. Computyper. Add-Punch machine. Automatic equipment for punching codes in tape. Ls(2000) Me(1934) Dc RMSa

General Electric Co., Tube Department, Schenectady, N. Y. / Schenectady 4-2211, X1027 / *C

Electronic tubes. Ls(15,000) Le(1878) Ic RMSPa

Gerber Scientific Instrument Co., 89 Spruce St., Hartford 1, Conn. / Ch 6-8539 / *C

Graphical computer "Graphanalogue". Ss Se (1946) Ic RMSa

Goodyear Aircraft Corp., Dept. 931, Akron 15, Ohio / Republic 3-6361 / *C

Goodyear electronic differential analyzers. (GEDA line of analog computing equipment). Ls Me Ac RMSa

Haller, Raymond and Brown, Inc., State College, Pa. / Ad 7-7611 / *C

Electronic digital computer for solution of up to 1200 simultaneous equations, using magnetic drum and tape. Research and development on computer components, analog computers, electronic and electromechanical systems. Engineering analysis, operations research, electronic development. Ms(200) Se(1947) Dc Ra

Helipot Corporation, 916 Meridian Ave., South Pasadena, Calif. / PY 1-2164 / *C

Precision potentiometers, single-and multi-turn, linear and non-linear, turns-counting dials. Ls(600) Se(1943) Ic RMSa

Hughes Research and Development Laboratories, Hughes Aircraft Co., Culver City, Calif. / Texas 0-7111 / *C

Automatic data-handling systems for commercial and military applications. Industrial control systems. Small, automatic electronic

digital and analog computers for airborne use. Fire-control equipment. Aircraft control. Guided missiles. Ls(15,000 company; 4,000 Res. and Devt. labs, 400 computers) Me(1937) DAc RMSa

Induction Motors Corp., 570 Main St.,Westbury, L.I., N. Y. / Westbury 7-7070 / *C
Motors: servo, gear, blower, &c. Ms(130) Se (1951) RMSCa

International Rectifier Corp., 1521 East Grand Ave., El Segundo, Calif. / Oregon 8-6281 / *C
Manufacturer of germanium diodes, selenium diodes, selenium photocells, selenium rectifiers. Ms(286) Se(1948) Ic RMSa

International Resistance Co., 403 North Broad St., Philadelphia 8, Pa. / Walnut 2-2166 / *C
Fixed and variable resistors, rectifiers, chokes. Ls(1500) Me(1924) Ic RMSa

A. Kimball Co., 307 West Broadway, New York 13, N. Y. / Canal 6-2300 / *C
Machine for printing and punching garment tags and specific type tickets. Input mechanisms. Ms(200) Le(1876) Ic RMSPa

Lektra Labs, Inc., 154 11th Ave., New York 11, N. Y. / Algonquin 5-2013 / *C
Electronic timers, sequence timers. Ss(25) Me(1940) CIc RMSa

Lewis and Kaufman, Ltd., 17320 El Rancho Ave., P. O. Box 337, Los Gatos, Calif. / El Gato 4-3540 / *C
Transmitting tubes, high vacuum rectifiers, and special purpose tubes. Ms(75) Se(1949) Ic RMSa

Arthur D. Little, Inc., 30 Memorial Drive, Cambridge 42, Mass. / University 4-9370 / *C
Analog digital converter, "Automatic Digital Recorder of Analog Data" (ADRAD). Conversion and input devices. Ls(800) Le(1886) Ic RCa

Log Abax S.A.R.L., 146 Avenue des Champs Elysees, Paris 8, France / Elysees 61-24 / *C
Collaborating with Institut Blaise Pascal on computing devices. Ms(400) Se(1949) Dc RMSa

Logistics Research Inc., 141 So. Pacific Ave., Redondo Beach, Calif. / Oregon 8-7108 / *C
Digital computers and computing systems (ALWAC). Data-reduction and data-handling systems, input and output equipment; automatic graph-plotters, automatic curve followers; large scale magnetic memories with "air-floating" magnetic heads, &c. Ss(33) Se(1952) DIc RMSa

Marchant Calculators, Inc., Oakland 8, Calif. / *C
Automatic electric calculators (desk type). Marchant-Raytheon Binary-Octal Calculator (desk type). Marchant "Miniac" electronic digital computer. Computer components. Data processing equipment. Ls(2500) Le (1910) DIc RMSa

Mid-Century Instrumatic Corp., 611 Broadway, New York 12, N. Y. / Spring 7-4016 / *C
Analog computers; six-channel recorders; electronic function generators; electronic multipliers, &c. Ss(27) Se(1950) Ac RMSa

Minnesota Electronics Corp., 3101 East 4 St., Minneapolis, Minn. / *C
Digital and analog computers. Magnetic components, magnetic decision elements. Data reduction systems, telemetering. Ss(35) Se (1946) DAIc RMSa

Minneapolis-Honeywell Regulator Co., Industrial Division, 4580 Wayne Ave., Philadelphia 44, Pa./ Michigan 4-8300 / *C
Automatic controllers. Brown Instruments. Servo components used in computers. Recording and indicating instruments and control equipment, &c. Amplifiers, converters, balancing motors, potentiometers, &c. Ls(3500) Le(1859) RMSa

Monroe Calculating Machine Company, Orange, N.J./ Orange 3-6600 / and elsewhere / *C
Desk calculating machinery for adding, calculating, and bookkeeping. SEE also Monrobot Corp. Ls(4,000) Le(1912) Dc RMSa

Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia, Pa. / Evergreen 6-0100, X981 / *C
Place where Eniac and Edvac electronic digital computers were constructed. Analog and digital equipment; simulators. Ms(80) Me(1923) DAc RCPa

National Bureau of Standards, Applied Mathematics Division, Washington 25, D. C. / EM 2-4040 / *C
(1) Numerical Analysis Section: Ss(10) Se (1954) Dc RGa
(2) Computation Laboratory: SEAC (Bureau of Standards Eastern Automatic Computer). Ms(50) Me(1938) Dc CPGa
(3) Statistical Engineering Laboratory: Ss (20) Se(1946) Dc RCPGa
(4) Mathematical Physics Section: Ss(10) Se (1954) Dc CPGa

National Physical Laboratory, Control Mechanisms and Electronics Division, Teddington, Middlesex, England. / *C
Digital computers, electronic simulators, data recording. Designer and builder of the Pilot Model of ACE (Automatic Computing Engine). Collaborates with English Electric Co. Ls(1,000; this division, 40) Le(1900) DIc RCPMa

National Semiconductor Products, 930 Pitner Ave., Evanston, Ill. / Davis 8-0800 / *C
Silicon semiconductors. Ms Me Ic RMSa

Northrop Aircraft Co., Hawthorne, Calif. / *C
Computing center; develops, maintains, operates own computing equipment. Digital plotter. Data reduction and analysis. Development of computing systems on order. Ms(70 this project) Se(1950 this project) DAc RCPa

Notifier Manufacturing Co., 239 South 11 Street, Lincoln 8, Nebraska / Lincoln 5-2946 / *C
Automatic control machinery for fire alarms. Automatic control circuits, computer circuits, switching circuits. Memory and pulse storing devices, transistor devices. Ss(35) Se(1949) CIc RMSCa

Ohmite Manufacturing Co., 3601 Howard St., Skokie, Ill. / Orchard 5-2600 / *C
Wire wound resistors, rheostats, rotary tap switches. Ls(500) Me(1925) Ic RMSa

Olivetti Corp. of America, 580 Fifth Ave., New York 36, N. Y. / Judson 2-0637 / and Ing. C. Olivetti & C., S.P.A., Ivrea, Italy / *C
Desk adding, calculating, and printing machines. Fully automatic printing calculators. Ls(6,000) Le(1908) Dc RMSa

Ortho Filter Corp., 196 Albion Ave., Paterson 2, N. J. / Mulberry 4-5858 / *C
Pluggable units for computers, cathode ray amplifiers, power supplies, wiring of complete racks, &c. Ss(43) Se(1946) Ic RMSa

Panellit, Inc., 7475 North Hamlin Ave., Skokie, Ill. / Orchard 5-2500 / *C
Equipment for automatic control: coordinated and graphic control panels for process variables; multiple-point scanning systems; annunciator systems. Ms(375) Se ISCMc RCMSPa

Phillips Control Corp., Joliet, Ill. / Joliet 3-3431 / *C
Relays for computers, &c. Ms(350) Se(1946) Ic RMSa

Radio Corporation of America, Tube Division, 415 South 5 St., Harrison, N. J. / Humboldt 5-3900/ *C
Tubes, transistors for computers. Ls Le Ic RMSa

Radio Materials Corp., 3325 North California Ave., Chicago 18, Ill. / Irving 8-3600 / *C
Manufacturers of ceramic capacitors. Ls(600) Se(1947) Ic RMSa

Radio Receptor Company, Inc., 251 West 19th Street, New York 11, N. Y. / Watkins 4-3633 / *C
Semi-conductor products, including transistors, diodes, selenium rectifiers. Ls(600?) Le(1922) Ic RMSa

Raytheon Manufacturing Co., Waltham, Mass. / Waltham 5-5860 / *C
Electronic computer systems for general accounting and data-processing operations, and for general scientific applications (RAYDAC). Magnetic-core coincident-current matrix memory systems, magnetic shift registers, binary and decade counters, magnetic core logical components and subsystems, tape-handling mechanisms, magnetic recording heads, magnetic amplifiers. Computing services to analyze and process problems in operations research, applied mathematics, engineering, and general business accounting by digital computer. Machine control, radar, sonar, communications, fire control, microwave and telemetering equipment, power and receiving tubes, diodes, transistors. Ls(20,000) Me(1925) DAc RMSPa

J. B. Rea Co., Inc., 1723 Cloverfield Blvd., Santa Monica, Calif. / Exbrook 3-7201 / *C
Automatic control systems; computing facility; &c. Ms(60) Se(1951) DSCc RMSCa

Servo Corporation of America, New Hyde Park, N.Y./ Fieldstone 7-2810 / *C
Servomechanisms. Automatic controls. Analysis and synthesis for controls manufacturers. Temperature controls by infra-red radiation. Industrial controls. Servo components and test equipment. Analog and digital computers. Ms(350) Se(1946) DASCc RMSa

Servomechanisms, Inc., Post & Stewart Ave., Westbury, L. I., N. Y., and 316 Washington St., El Segundo, Calif. / Westbury 7-2700 and El Segundo 1517 / *C
Automatic electronic and electro-mechanical control systems and components, analog computers, instrumentation. Ls(700) Se(1946) ASICc RMSa

Swedish Board for Computing Machinery, Drottninggatan 95A, (P.O.Box 6131), Stockholm 6, Sweden/ Stockholm 23 55 90 / *C
State central institution for research, development, and computation service on large-scale machines. Operates two computers, BARK and BESK, designed and built by the Board. They have run commercially, BARK since July 1950, and BESK since March 1954. BARK is a binary, automatic relay computer, orders set up on a plug-board, parallel-operating, three-(four-) address system. BESK is a binary, electronic sequence computer, storing orders and data in a parallel Williams memory or in a magnetic drum memory, one-address system, parallel-operating. Further activities of the Board are research on numerical analysis and development of new computers. Ss(30) Se(1949) Dc RMCPa

Taller and Cooper, 75 Front St., Brooklyn, N.Y./ Ulster 8-0500 / *C
Data recording and conversion systems, printers, perforators, analog to digital converters. Function generators, computers. Mechanical function generator control of machine tools and allied mechanisms. Toll equipment for bridges, highways, turnpikes. Ms(350) Me(1926) DIc RMSa

Tally Register Corp., 5300 14th Ave. N.W., Seattle 7, Wash. / Dexter 5500 / *C
Special-purpose business machines; electromagnetic pulse counters and pulsed relays; high-speed data reduction systems for telemetering applications; digital-input, multiple-symbol X-Y plotter with continuous grid printing; numeric printing tape punch; printing transfer key punch. Ss(15) Se(1948) DICMc RMSCa

Technitrol Engineering Co., 2751 North 4 Street, Philadelphia 33, Pa. / Ga 6-9105 / *C
Computing and control equipment. Complete digital systems. Components, pulse transformers. Electrical and acoustic delay lines. High-speed memories. Time serial computers. Ms(90) Se(1947) DAc RMSa

Teleregister Corp., 445 Fairfield Ave., Stamford, Conn. / Stamford 48-4291 / *C
Digital and analog special purpose computers. Data inventory systems for special applications -- travel reservations, flight data processing, stock market quotations, &c. Magnetronic Revisor, in use at American Airlines reservations center. Magnetronic stock quotation system in use in Toronto Stock Exchange. Ms(275) Me(1928) DIc RMSa

Tobe Deutschmann Corporation, 921 Providence Highway, Norwood, Mass. / Norwood 7-2620 / *C
Capacitors; electronic noise suppression products (interference filters). Ls(500+) Le(1922) Ic RMSCPa

Transistor Products, Inc., 241 Crescent St., Waltham 54, Mass. / Waltham 5-9330 / *C
Transistors, diodes. Ms(150) Se(1952) Ic RMSa

United Transformer Co., 150 Varick St., New York 13, N. Y. / Algonquin 5-3500 / *C
Transformers, reactors, filters, high Q coils. Ls(500+) Me(1933) Ic RMSa

U. S. Air Force, Aeronautical Research Laboratory, System Dynamics Analysis Branch, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio / KE 7111, X28235 / *C
Has Oarac, and analog equipment. Ms(65) Se(1948) DAc RCGPa

U. S. Naval Proving Ground, Computation and Ballistics Department, Dahlgren, Va. / X627 / *C
Has three digital computers: Harvard Aiken Relay (Mark II), Aiken Dahlgren Electronic (Mark III), and will have Naval Ordnance Research Calculator (NORC). Ms(110) Se(1942) Dc RCPGa

(continued on page 14)

Forum

THE SPEAKING HEAD MADE BY POPE SYLVESTER II

Mrs. John Bennett Surrey, England

"It would not speak except when questioned, but would truly answer 'Yes' or 'No'."

This well mannered object, which, so we are told, took the form of a statue of a human head, is unfortunately not available for the present day business man who dreams of having such an easily operated and understood mechanical aid on his desk. In fact, it has so far existed only in the imagination of 11th and 12th century chroniclers of the Frenchman Gerbert, schoolmaster of Rheims, who, in the year 999 became Pope Silvester II.

Moreover, to be the possessor of this oracle, even the legendary possessor, apparently one must be a man of no ordinary learning, inventiveness and mechanical skill. Gerbert, born in humble circumstances, was first educated at a French monastery, but, when in his early twenties, made use of an opportunity to travel to Spain, there to study mathematics, and, as his legend makers would have it, all forms of magic and necromancy. From there, after a short period teaching in the Italian Court, he became a schoolmaster of Rheims, where he gained great fame as a teacher. He drew his pupils from the sons of the ecclesiasts and nobles of Germany and of France, and through them he eventually had a wide influence on European politics.

During this time he was in fact, if not building Speaking Heads, at least responsible for the construction of many instruments for assisting in the study of mathematics, astronomy and music. In particular he introduced the use of the abacus, knowledge of which he probably gained from the Arabs while he was studying in Spain. He also built organs, sundials and globes, which were the envy and wonder of his contemporaries.

Small wonder then that he should later be credited with the construction of a Speaking Head, which he "fashioned....under a certain aspect of the stars -- that is just at the time when all the planets were about to begin their course." No question, past, present, or future, was, apparently beyond the ken of this rival of the wicked Queen's "Mirror on the wall" and forerunner of modern mechanical brains. Later day inventors might note, however, the pitfalls of the Yes-No principle, particularly when applied to predictions of the future. Gerbert is said to have consulted the oracle about the circumstances of his death, and to have misinterpreted its reply to mean that he would have a long life -- and therefore, he decided, a gay one. Death came unexpectedly soon, and he discovered his mistake only just in time, so we are told, to repent of his sins.

One more word of warning -- Gerbert was able to produce this machine only because he was in league with the Devil, and had sworn eternal fealty to him!

- END -

ROSTER OF ORGANIZATIONS
(continued from page 13)

U. S. Navy, Office of Naval Research, Special Devices Center, Port Washington, New York / Port Washington 7-2800 / *C
Ls(500) Se(1943) DASMc RMCGBa

Wang Laboratories, 37 Hurley St., Cambridge 39, Mass. / Trowbridge 6-1925 /
Magnetic delay-line memory units. Digital signal generators. Multiple scalers. Static magnetic memory systems and other devices. Ss Se(1951) Dc RCMSa

Watson Scientific Computing Laboratory, 612 West 116 St., New York, N. Y. / Monument 6-9700 / *C
The pure science department of International Business Machines Corp. Simultaneous linear equation solver. Astronomical plate measuring machine. IBM punch card machines. Research and instruction. Constructing NORC. Ms(100) Se(1945) DAc RCPa.

Jervis B. Webb Co., 8951 Alpine Ave., Detroit 4, Mich. / Webster 3-8010 / *C
Conveyor engineering and manufacturing. Servomechanisms, automatic control machinery, automatic materials handling machinery. Ls (600) Le(1919) SCMc RMSa

Wharf Engineering Labs., Fenny Compton, Warwickshire, England / Fenny Compton 30 / *C
Magnetic drums, recording heads, transformers. Ss(15) Se(1949) Ic RMSa

Winchester Electronics, Inc., Willard Rd., Norwalk, Conn. / Temple 8-8433 / *C
Electrical connectors and terminals. Ms(300) Se(1945) Ic RMSa

Zator Co., 79 Milk St., Boston 9, Mass. / Liberty 2-4624 / *C
Digital equipment and systems for coding, filing, and finding information (Zato coding systems). High-speed selectors for notched cards. Methods for use of digital computing machines to recover information. Ss Se (1947) Ic RCSa

Zeuthen & Aagaard Ltd., 6 Esplanaden, Copenhagen, Denmark / Central 3795 / *C
Portable adding machine (Contex); dictating machine (Rex-Recorder) with magnetic recording on plastic disc using impregnated particles and permitting more than 10,000 re-uses; duplicating machines, &c. Ls Le Ic RMSa

- END -

AUTOMATIC COMPUTERS -- LIST

(Supplement, information as of September 3, 1954)

The purpose of this list is to report automatic computers in existence (all that are known to us). Each entry, when complete, gives: name of computer (and interpretation of letters) / maker and place where made; if quantity is 1 or 2, place where computer is located / purpose of computer, nature of computer, approximate size or capacity of computer, and quantity of computer in existence. Some words like "Model" and "Type" have been omitted from names of computers; usually the initial letters of the company name have been substituted.

This list is a supplement and contains only additions or corrections as compared with the cumulative list published in COMPUTERS AND AUTOMATION, vol. 3, no. 6, July 1954, p. 18...., which see.

Abbreviations: The key to the special abbreviations follows:

Purpose (p)

Gp	General purpose
Sp	Special purpose

Nature of Computer (c)

Dc	Digital computer
Ac	Analog computer
Ec	Electronic computer
Rc	Relay computer
Mc	Mechanical computer

Size (s)

Ss	Small size or low capacity
Ms	Medium size or medium capacity
Ls	Large size or large capacity

Quantity (q)

0q	Zero (i.e., unfinished or dismantled)
1q	One
2q	Two
Sq	Small quantity, about 2 to 6
Mq	Medium quantity, about 7 to 30
Lq	Large quantity, over 30
?q	Unknown quantity

Some other abbreviations have been used which can be easily guessed, like those in a telephone book.

We plan to keep this list up to date from time to time, and we shall be very grateful for any information which any reader is able to send us.

LIST

Abel — same as the ONR Relay Computer, which see

Arra (Automatische Relais Rekenmachine Amsterdam) / Mathematisch Centrum, Amsterdam, the Netherlands; located there/ Gp EDc (not relay) Ls 1q

Amos (Automatic computer Ministry of Supply) -- a Ferranti computer; see Ferranti

APE(R)C (All Purpose Electron (Rayon) Computer) Birkbeck College, London, Eng; located at British Rayon Research, Manchester, Eng / Gp EDc Ms 1q

Bendix Decimal Digital Differential Analyzer / Bendix Computer Div, Bendix Aviation Corp, Los Angeles, Calif; located there / Sp EDc Ms 1q

CEC 36-101 (Consolidated Engineering Corp. 36-101) ElectroData Corp, affiliate of Consol Engrg Corp, Pasadena, Calif / Gp EDc Ls Sq

CRC 102 (also called Cadac 102; Computer Research Corporation 102) / National Cash Register Co., Electronics Division, Hawthorne, Calif.; located at Project Lincoln, Mass. Inst. of Technology, Bedford Airport, Mass. / Gp EDc Ls 1q

CRC 102A (also called Cadac 102A); Computer Research Corporation 102A / National Cash Register Co., Electronic Computer Division, Hawthorne, Calif / Gp EDc Ls Mq

CRC 105 (Computer Research Corporation 105) / National Cash Register Co., Electronics Div, Hawthorne, Calif / Sp (decimal digital differential analyzer) EDc Ls Mq

CRC 107 (Computer Research Corporation) / National Cash Register Co, Electronics Div, Hawthorne, Calif / Gp EDc Ls Sq

Cuba (Calculateur Universel Binaire de l'Armement) / Société d'Électronique et d'Automatisme; Paris, France; located at Laboratoire Central de l'Armement, Paris, France / Gp EDc Ls 1q

Elecom 200 (also called Ordfiac) / Electronic Computer Corp, L I City, N. Y; located at Letterkenny Ordnance Depot, ? / Gp EDc Ls 1q

Elliot 402 / Elliott Brothers, Computing Machine Division, Borehamwood, Herts., Eng / Gp EDc Ls ?q

G 1 (Göttingen) / Max-Planck-Institut für Physik, Göttingen, Germany; located there / Sp EDc Ss 1q

G 2 (Göttingen) / Max-Planck-Institut für Physik, Göttingen, Germany / Gp EDc Ls 1q

Gamma 3 / Compagnie des Machines Bull, Paris, France / Gp EDc Ls Sq

Harwell Computer / Atomic Energy Research Establishment, Harwell, Berkshire, Eng; located there / Sp REDc (dekatrons) Ms 1q

HEC (Hollerith Electronic Computers 1 and 2) / British Tabulating Machines Co., London, Eng/ ?p ?c ?s ?q

IBM 602A (Calculating Punch) / International Business Machines Corp., New York / Gp (short sequences) RDc Ss Mq

IBM 604 (Electronic Calculating Punch) / International Business Machines Corp, New York / Gp (60 program steps) EDc Ss Mq

IBM 607 (Electronic Calculator) / International Business Machines Corp, New York / Gp (140 program steps) EDc Ls Mq

IBM 703 (Electronic Data Processing Machine for File Maintenance) / International Business Machines Corp, New York / Sp EDc Ls ?q

IBM 704 (Electronic Data Processing Machine for Scientific Purposes) / International Business Machines Corp, New York / Gp EDc Ls ?q

Icce (Imperial College Computing Engine) / Imperial College of Science and Technology, London, Eng; located there / Gp Rc Ls lq

IRSIA-FRNS Computer / Bell Telephone Mfg Co, Antwerp, Belgium / Gp EDc Ls Lq

Jaincomp C / Jacobs Instrument Co, Bethesda, Md / Sp EDc Ss lq

Johnniac -- same as the Rand Computer, which see

Leo (Lyons Electronic Office) / J. Lyons and Co., Ltd, London; located there / Gp EDc (like Edsac) ls lq

Magic (Magnetic and Germanium Integer Calculator) / Wharf Engrg Laboratories, Fenny Compton, Warwickshire, Eng / ?p EDc ?s ?q

Magnetronic Reservisor / The Teleregister Corp, Stamford, Conn; located at American Airlines, La Guardia Airport, New York / Sp (reservations inventory) EDc Ls lq

Manchester Electronic Computer -- same as Ferranti computer, which see

Maniac (Mathematical Analyzer, Numerical Integrator and Computer) / Los Alamos Scientific Laboratory, Los Alamos, New Mexico; located there / Gp EDc Ls lq

Mark 22 Computer (Bell Telephone Model IV computer) / Bell Telephone Laboratories, New York; located at Naval Research Laboratory, Washington, D C / Sp RDc Ls lq

Milac (Miller Analog Computer) / William Miller Instruments, Inc, Pasadena, Calif / Gp EAc Ls Sq

Minac (Minimal Automatic Computer) / Digital Computing Group, California Inst of Technology Pasadena, Calif / Gp EDc Ss Oq

Mosaic (Ministry of Supply Arithmetical Integrator and Calculator) / Post Office Research Section, London, Eng; located at Radar Research Establishment, Malvern, Eng / Gp EDc Ls lq

Norwegian Computer / Central Institute, Royal Norwegian Council for Scientific and Industrial Research, Norway; located at Norwegian Computing Centre, Oslo University, Blindern, Norway / Gp EDc Ms lq

Omibac / Aeronautical and Ordnance Systems Div, General Electric Co, Schenectady, N Y; located there / Gp EDc Ls lq

ONR Relay Computer (Office of Naval Research) / - ; located at Logistics Research Project, George Washington Univ, Washington, D C / Gp RDc Ms lq

Ordfiac -- same as Elecom 200, which see

Perm (Programmgesteuerte Elektronenrechenmaschine, Munchen) / Technische Hochschule, Munich, Germany / Gp EDc Ls lq

Ptera (Postal Telecommunications Electronic Automatic Calculator) / Central Laboratory of the Postal and Telecommunications Services, the Hague, Netherlands / Gp EDc Ls lq

Rascal (Royal Air Force Sequence Controlled Calculator Mark II) / Royal Aircraft Establishment, Farnborough, Hampshire, Eng; located there / Gp EDc Ms lq

R 4 S / Eidgenossische Technische Hochschule, Zurich, Switz; to be located there / Gp EDc Ls Oq

Rechenautomat IPM / Institut für Praktische Mathematik, Technische Hochschule, Darmstadt, Germany; located there / Gp EDc Ls lq

Remington Rand 409-2 and 409-2R / Remington Rand, Inc., New York / Gp REDc Ss Mq

Stevens Institute of Technology Digital Differential Analyzer / Experimental Towing Tank, Stevens Institute of Technology, Hoboken, N J / Sp EDc Ms lq

TAC (Tokyo Automatic Computer) / Tokyo Shibaura Electric Manufacturing Co, Tokyo, Japan; located at the University of Tokyo, Tokyo, Japan / Gp EDc Ls lq

Tokyo Mark I / Laboratory of Applied Mathematics, Electrotechnical Laboratory, Tokyo, Japan; located there / Sp RDc Ss lq

Tokyo Mark II / Laboratory of Applied Mathematics, Electrotechnical Laboratory, Tokyo, Japan/located there / Gp RDc Ls lq

TRE Computer (Telecommunications Research Establishment Computer) / Telecommunications Research Establishment, Great Malvern, Eng; located there / Gp EDc Ls lq

Udec II (Unitized Digital Electronic Computer) / Burroughs Corp, Electronic Instruments Div, 1209 Vine St., Philadelphia, Pa / Gp EDc Ls lq

Wisc (Wisconsin Integrally Synchronized Computer) University of Wisconsin, Electrical Engrg Dept, Madison, Wisc; located there / Gp EDc Ls lq

Zuse Model 5 / Konrad G. Zuse, Neukirchen (Kreis Hunfeld), Germany; located at Leitz Optical Works, Wetzlar, Germany / Gp RDc Ss lq

- END -

Forum

ANOTHER AUTOMATIC FACTORY

George W. Patterson,
Burroughs Corp., Paoli, Pa.

In a recent issue of COMPUTERS AND AUTOMATION, I noted a list of references on automatic factories. I think you might wish to add:

> "Development and Manufacture of Electroformed Conductor for Telephone DropWire," by A.N. Gray and G.E. Murray, in 32 Bell System Tech. Journal 1099-1135 (September, 1953).

Five men operate a two-million dollar system which produces two-million dollars of products annually."

To you who would like to be right every time:

It's no easy job in today's economy to make the right decision every time.

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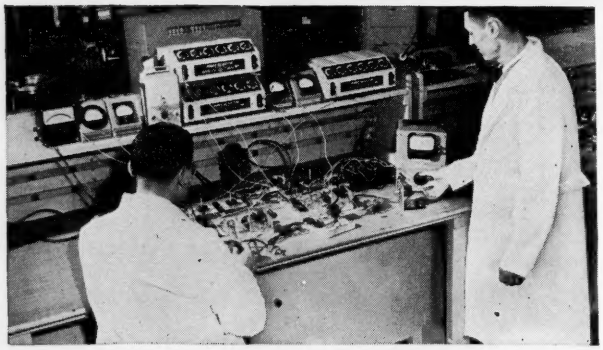
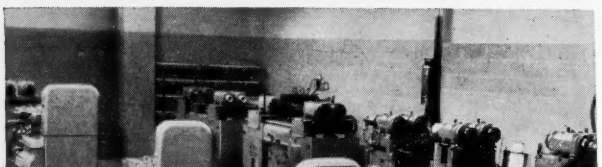
Ketay offers a complete range of sizes and types of rotating components . . . synchros, servo motors, and resolvers. Specifications for 116 of them are contained in an illustrated brochure, available upon request.



Ketay leadership is the result of sound, imaginative engineering. From the design of a specialized component to the fabrication of complete systems, Ketay engineers create the "standards of tomorrow".



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Ketay leadership is the result of a combination of research, experience, and outstanding manufacturing facilities. Some of these facilities are pictured here.

Ketay has produced many *firsts* in automatic controls. For example, in Synchros, Ketay was first to produce miniaturized Synchros so remarkable for their high accuracy and unmatched reliability. Ketay was *first* to produce high temperature and corrosion resistant Synchros.

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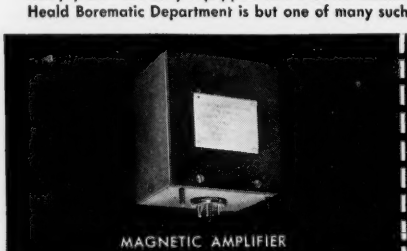
Ketay Manufacturing Corporation

Executive Offices:
555 Broadway, N. Y.

New York Division
Electronic Instrument

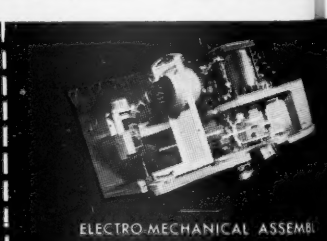
Pacific Di
12833 Si

Kinetix I
Research



MAGNETIC AMPLIFIER

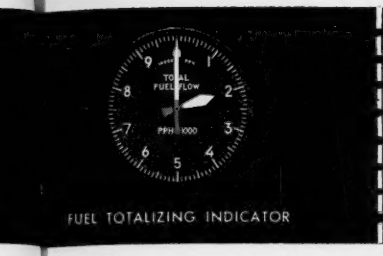
RESOLVER AMPLIFIER



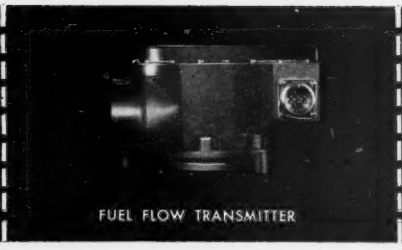
ELECTRO-MECHANICAL ASSEMBL

TAC

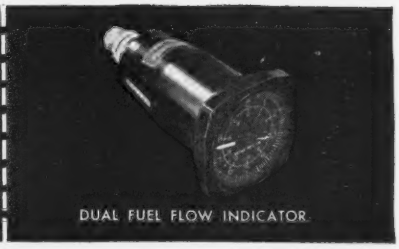
Components for complete systems including gear trains and amplifiers of conventional and miniaturized types are available to meet the most demanding of design requirements.



FUEL TOTALIZING INDICATOR



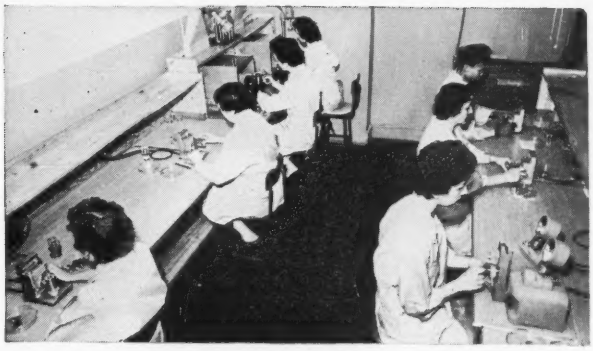
FUEL FLOW TRANSMITTER



DUAL FUEL FLOW INDICATOR

Electronic control devices are among the many instruments Ketay manufactures for aircraft, missiles, marine, ordnance, and civilian application. Special designs to meet the limitations of space and operating conditions.

Ketay



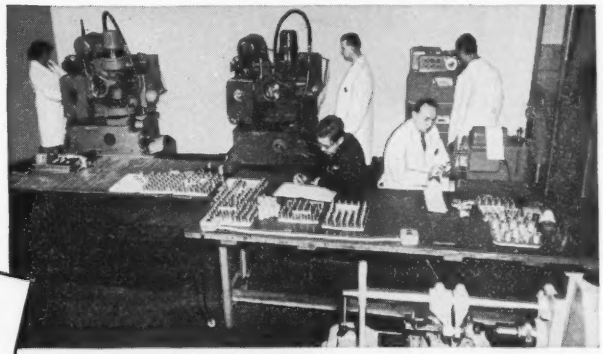
Inspection of all parts, sub-assemblies, as well as completed instruments, is a fetish at Ketay. For instance, all bearings are inspected with specially developed equipment in air conditioned work space. This is just one of the many techniques that assure maximum performance when Ketay units are specified.

electro-mechanical devices some of which are illustrated on these pages. Currently, original Ketay developments are providing instrument performance far above present standards—many of which were set by earlier Ketay developments.

Ketay successfully applies its production facilities and experienced research personnel to specific problems for the leaders in automatic control.

Your interest will be well served by learning fully of the products and services you may obtain from Ketay.

Write, today, for descriptive specifications of those types of Ketay instruments which may be applied to your designs.



Precision of manufacture is vital in every Ketay unit. To assure continuing reliability for its products, Ketay employs the very latest facilities and techniques. Typical is this "gear room" where modern gear cutting machinery produces gears to the finest of tolerances.

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The MONROBOT is a general purpose digital computer, compact, ruggedized, reliable and reasonably priced. In the MONROBOT, decimal numbers are used. Since twenty digits are available, with a centrally located decimal point, there is no need for scaling or setting of decimal point. Neither overflow nor translation techniques are necessary. Orders are written for the calculator in virtually their original algebraic form.

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MONROBOT CORPORATION

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BOOKS AND OTHER PUBLICATIONS

(List 9: COMPUTERS AND AUTOMATION, vol. 3, no. 8, Oct., 1954)

This is a list of books, articles, periodicals, and other publications which have a significant relation to computers or automation, and which have come to our attention. We shall be glad to report other information in future lists, if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / a few comments. If you write to a publisher or issuer, we would appreciate your mentioning the listing in COMPUTERS AND AUTOMATION.

Andlinger, Gerhard R., and others / Operations Research: Challenge to Modern Management / O.R. Associates, Box 245, Cambridge 38, Mass./1954, photooffset, 120 pp, $10

An interesting, comprehensive and important report prepared by a group of nine second-year students in Harvard University Graduate School of Business Administration on the applications and future of operations research in business and management. Chapter 8, "The Relation of Computers to O.R.", discusses the need for computers in operations research, types of computers available, and some examples of their use to solve problems. The next edition it is hoped will eliminate a number of minor errors.

Aiken, Howard H., and others / Description of a Magnetic Drum Calculator / Harvard University Press, Cambridge 38, Mass. / 1952, photooffset, 318 pp, $8

This magnetic drum calculator is the Harvard Mark III which was delivered to the Naval Proving Ground, Dahlgren, Va., in March, 1950, and which commenced operating in 1951. The drums store 4200 quantities of 16 decimal digits each; the calculator adds in 5 milliseconds and multiplies in 13. This book may be the only fairly complete description of the detailed construction of an electronic computer so far published.

Bowden, B. V., editor, and others / Faster than Thought -- A symposium on Digital Computing Machines / Sir Isaac Pitman & Sons, Ltd, London, England / 1953, printed, 416 pp, $6(?)

An interesting, informative, well organized and well-written book, written by 24 contributors, including Dr. B. V. Bowden. The three parts of the book are: The History and Theory of Computing Machines; Electronic Computing Machines in Britain and America; Applications of Electronic Computing Machines. The last part includes discussion of their use in crystallography, meteorology, astronomy, economics, chess, &c. Important.

Eshbach, Ovid W., editor / Handbook of Engineering Fundamentals / John Wiley and Sons, 440 4th Ave., New York 16, N. Y. / 1952, printed, 1500 pp(?) (not consecutively numbered), $10

Sections: Mathematical and Physical Tables; Mathematics; Physical Units and Standards; Mechanics of Rigid Bodies, Mechanics of Deformable Bodies, Mechanics of Incompressible Fluids; Aerodynamics; Engineering Thermodynamics; Electricity and Magnetism; Radiation, Light and Acoustics; Chemistry; Metallic Materials; Nonmetallic Materials; Engineering Law. A useful, authoritative, standard reference for a computing laboratory.

Institute of Radio Engineers / Convention Record of the IRE, 1954 National Convention: Part 4, Electronic Computers and Information Theory / Institute of Radio Engineers, Inc., 1 East 79 St., New York 21, N. Y. / 1954, photooffset, 144 pp, $4.50

Contains 25 papers given at the IRE March, 1954 meeting on: application of information theory to communication systems; coding and noise; speed and computation; computer design and techniques; computer components.

Milne, William Edmund / Numerical Solution of Differential Equations / John Wiley and Sons, 440 4th Ave., New York 16, N. Y. / 1953, printed, 275 pp, $6.50

Topics include elementary numerical solution, analytical foundations, methods based on numerical integration, two-point boundary conditions, partial differential equations, linear equations and matrices, the Monte Carlo Method. An excellent, practical book for human computers, with dozens of computations given completely. It has been written with full realization of the powers of automatic computers.

Office of Naval Research / A Survey of Automatic Digital Computers, Report 111293 / U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C. / 1953, photooffset, 109 pp, $2.00

An important report giving full, comparable, technical details on 98 automatic computers, based on information collected generally in February, 1953.

Troll, John H. / "The Thinking of Men and Machines" in "The Atlantic", July, 1954 / The Atlantic Monthly, 8 Arlington St., Boston, Mass./ 1954, printed, pp 62-65, 50 cents

A discussion of the "furtive rivalry" between man and machine. Contains many ideas.

Institute of Radio Engineers' Professional Group on Electronic Computers / Newsletter No. 5, June 15, 1954 / IRE PGEC, The Institute of Radio Engineers, Inc., 1 East 79 St., New York

(continued on page 24)

ROBOTS I HAVE KNOWN

Issac Asimov
Author of "I, Robot" and other stories

Mechanical men, or, to use Capek's now universally-accepted term, robots, are a subject to which the modern science-fiction writer has turned again and again. There is no uninvented invention, with the possible exception of the spaceship, that is so clearly pictured in the minds of so many: a sinister form, large, metallic, vaguely human, moving like a machine and speaking with no emotion.

The key word in the description is "sinister" and therein lies a tragedy, for no science-fiction theme wore out its welcome as quickly as did the robot. Only one robot-plot seemed available to the average author: the mechanical man that proved a menace, the creature that turned against its creator, the robot that became a threat to humanity. And almost all stories of this sort were heavily surcharged, either explicitly or implicitly, with the weary moral that "there are some things mankind must never seek to learn."

This sad situation has, since 1940, been largely ameliorated. Stories about robots abound; a newer viewpoint, more mechanistic and less moralistic, has developed. For this development, some people (notably Mr. Groff Conklin in the introduction to his recent science-fiction anthology entitled "Science-Fiction Thinking Machines", published in 1954) have seen fit to attach at least partial credit to a series of robot stories I wrote beginning in 1940. Since there is probably no one on Earth less given to false modesty than myself, I accept said partial credit with equanimity and ease, modifying it only to include Mr. John W. Campbell, Jr., editor of "Astounding Science-Fiction", with whom I had many fruitful discussions on robot stories.

My own viewpoint was that robots were story material, not as blasphemous imitations of life, but merely as advanced machines. A machine does not "turn against its creator" if it is properly designed. When a machine, such as a power-saw, seems to do so by occasionally lopping off a limb, this regrettable tendency towards evil is combatted by the installation of safety devices. Analogous safety devices would, it seemed obvious, be developed in the case of robots. And the most logical place for such safety devices would seem to be in the circuit-patterns of the robotic "brain".

Let me pause to explain that in science-fiction, we do not quarrel intensively concerning the actual engineering of the robotic "brain". Some mechanical device is assumed which in a volume that approximates that of the human brain must contain all the circuits necessary to allow the robot a range of perception-and-response reasonably equivalent to that of a human being. How that can be done without the use of mechanical units the size of a protein molecule or, at the very least, the size of a brain cell, is not explained. Some authors may talk about transistors and printed circuits. Most say nothing at all. My own pet trick is to refer, somewhat mystically, to "positronic brains", leaving it to the ingenuity of the reader to decide what positrons have to do with it and to his good-will to continue reading after having failed to reach a decision.

In any case, as I wrote my series of robot stories, the safety devices gradually crystallized in my mind as "The Three Laws of Robotics." These three laws were first explicitly stated in a story of mine called "Runaround", which appeared in the March, 1942 issue of "Astounding Science Fiction". As finally perfected, and restated in my book "I, Robot" (a collection of nine of my robot stories published in 1950) the Three Laws read as follows:

> First Law -- A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
>
> Second Law -- A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
>
> Third Law -- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

These laws are firmly built into the robotic brain, or at least the circuit equivalents are. Naturally, I don't describe the circuit-equivalents. In fact, I never discuss the engineering of the robots for the very good reason that I am colossally ignorant of the practical aspects of robotics.

The First Law, as you can readily see, immediately eliminates that old, tired plot which I will not offend you by referring to any further.

Although, at first flush, it may appear that to set up such restrictive rules must hamper the creative imagination, it has turned out that the Laws of Robotics have served as a rich source of plot material. They have proved anything but a mental road-block.

An example would be the story "Runaround" to which I have already referred. The robot in that story, an expensive and experimental model, is designed for operation on the sunside of the planet Mercury. The Third Law has been built into him more strongly than usual for obvious economic reasons. He has been sent out by his human employers, as the story begins, to obtain some liquid selenium for some vital and necessary repairs. (Liquid selenium lies about in puddles in the heat of Mercury's sunward side, I will ask you to believe.)

Unfortunately, the robot was given his order casually so that the Second Law circuit set up was weaker than usual. Still more unfortunately, the selenium pool to which the robot was sent was near a site of volcanic activity, as a result of which there were sizable concentrations of carbon monoxide in the area. At the temperature of Mercury's sunside, I surmised that carbon monoxide would react fairly quickly with iron to form volatile iron carbonyls so that the robot's more delicate joints might be badly damaged. The further the robot penetrates into this area, the greater the danger to his existence and the more intensive is the Third Law effect driving him away. The Second Law, however, ordinarily the superior, drives him onward. At a certain point, the unusually weak Second Law potential and the unusually strong Third Law potential reach a balance and the robot can neither advance nor retreat. He can only circle the selenium pool on the equipotential locus that makes a rough circle about the site.

Meanwhile, our heroes must have the selenium. They chase after the robot in special suits, discover the problem and wonder how to correct it. After several failures, the correct answer is hit upon. One of the men deliberately exposes himself to Mercury's sun in such a way that unless the robot rescues him, he will surely die. That brings the First Law into operation, which being superior to both Second and Third, pulls the robot out of his useless orbit and brings on the necessary happy ending.

It is in the story "Runaround", by the way, that I believe I first made use of the term "robotics" (implicitly defined as the science of robot design, construction, maintenance, etc.) Years later, I was told that I had invented the term and that it had never seen publication before. I do not know whether this is true. If it is true, I am happy, because I think it is a logical and useful word, and I hereby donate it to real workers in the field with all good will.

None of my other robot stories spring so immediately out of the three Laws as does "Runaround" but all are born of the Laws in some way. There is the story, for instance, of the mind-reading robot who was forced to lie because he was unable to tell any human being anything other than that which the human in question wished to hear. The truth, you see, would almost invariably cause "harm" to the human being in the form of disappointment, disillusion, embarrassment, chagrin and other similar emotions all of which were but too plainly visible to the robot.

Then there was the puzzle of the man who was suspected of being a robot, that is, of having a quasi-protoplasmic body and a robot's "positronic brain." One way of proving his humanity would be for him to break the First Law in public, so he obliges by deliberately striking a man. But the story ends in doubt because there is still the suspicion that the other "man" might also be a robot and there is nothing in the Three Laws that would prevent a robot from hitting another robot.

And then we have the ultimate robots, models so advanced that they are used to precalculate such things as weather, crop harvests, industrial production figures, political developments and so on. This is done in order that world economy may be less subject to the whims of those factors which are now beyond man's control. But these ultimate robots, it seems, are still subject to the First Law. They cannot through inaction allow human beings to come to harm, so they deliberately give answers which are not necessarily truthful and which cause localized economic upsets so designed as to maneuver mankind along the road that leads to peace and prosperity. So the robots finally win the mastery after all, but only for the good of man.

The interrelationship of man and robot is not to be neglected. Mankind may know of the existence of the Three Laws on an intellectual level and yet have an ineradicable fear and distrust for robots on an emotional level. If you wanted to invent a term, you might call it a "Frankenstein complex". There is also the more practical matter of the opposition of labor unions, for instance, to the possible replacement of human labor by robot labor.

This, too, can give rise to stories. My first robot story concerned a robot nursemaid and a child. They child adored its robot as might be expected, but the mother feared it, as might also be expected. The nub of the story lay in the mother's attempt to get rid of it

(continued on page 26)

(continued from page 21)

21, N. Y. / 1954, mimeographed, 9 pp, free to members of PGEC

Report of the discussions which followed the first two sessions on electronic computers at the March, 1954 IRE Convention in New York. These discussions are not published in the "Convention Record".

Clippinger, R. F., B. Dimsdale, and J. H. Levin / "Automatic Digital Computers in Industrial Research, II", in the "Journal of the Society for Industrial and Applied Mathematics", vol. 1, no. 2, December, 1953 / Society for Industrial and Applied Mathematics, c/o I. Edward Block, Philco Corp., Philadelphia 34, Pa. / 1953, photo-offset, pp 91-110, $2.00 the issue

Second article in a series on Automatic Digital Computers in industrial research. Discussion of problems in the design of an optical system, where, given certain properties such as focal length and aperture, it is required to determine the number, shapes, and positions of optical elements required to focus the light from a given region onto a given region. Gives problem, solution, and analysis of the errors.

Clippinger, R. F., B. Dimsdale, and J. H. Levin/ "Automatic Digital Computers in Industrial Research, IV" / Raytheon Manufacturing Co., Waltham, Mass. / 1954, photooffset, 21 pp, free

Discusses a wide range of problems suitable for solution by means of some digital computer: payroll, labor distribution, materials distribution, magazine subscription lists, department store operations, transportation, scheduling, water management, &c.

Operations Research Society of America / Journal of the Operations Research Society of America, vol. 2, no. 2, May, 1954 / Operations Research Society of America, Mount Royal & Guilford Ave., Baltimore 2, Md. / 1954, printed, 228 pp, $1.50 per issue, $6.00 per year

Papers on: traffic delays at toll booths; the influence of servicing times in queuing processes; scheduling a military tanker fleet; organization and information-handling in task groups; three more papers; letters to the editor; &c.

Systems and Procedures Association of America / Systems and Procedures Quarterly, vol. 5, no. 2, May, 1954 / Systems and Procedures Association of America, 330 West 42 St., New York 36, N.Y./ 1954, printed, 22 pp, $3.75 a year, $1.00 per issue

Contains six articles: Systems English -- Let's Keep it Simple; Corporate Politics; Manuals for Business; Question for Analysts; Tabulating on a Service Basis; the Evaluation of Systems Functions; and other features.

Bauer, Louis / New Laboratory for Three-Dimensional Guided Missile Simulation / Project Cyclone, Reeves Instrument Corporation, 215 East 91 St., New York 28, N. Y. / 1954, photooffset, 18 pp, free

Report of equipment and operation in a laboratory for study of guided missile behavior. Reprint of a paper delivered at the Joint Computer Conference, February, 1953.

Brayer, Herbert O. / "The Truth about Electronic Business Machines" reprinted from "American Business" / Dartnell Publications, Inc., 4660 Ravenswood Ave., Chicago 40, Ill. / 1953(?), photooffset, 16 pp, limited distribution

An account of machines, possibilities, and actual applications.

Business Week / "Selling the Analog Computer" in "Business Week", May 22, 1954 / McGraw-Hill Publishing Co., 330 West 42 St., New York 36, N. Y. / 1954, printed, p 90 ..., cost ?

Uses and applications of analog computers, mainly in engineering in many manufacturing plants.

Business Week / "Counting on an Automatic Boom" in "Business Week", May 22, 1954 / McGraw-Hill Publishing Co., 330 West 42 St., New York 36, N. Y. / 1954, printed, p 178 ..., cost ?

Report on Beckman Instruments' approach to the automatic handling of information.

Loveman, Bernard / "Reliability of a Large Reac Installation", reprint from the "Proceedings of the Eastern Joint Computer Conference", Washington, D. C., Dec., 1953 / Reeves Instrument Co., 215 East 91 St., New York 28, N.Y./ 1953, printed, 5 pp, free

Report on the Project Cyclone installation, the acceptance test, reliability definition, reliability data, and design features.

Institute of Radio Engineers' Professional Group on Electronic Computers / Transactions of the IRE PGEC, vol. EC-3, no. 2, June, 1954 / The Institute of Radio Engineers, Inc., 1 East 79 St., New York 21, N. Y. / 1954, printed, 58 pp, $4.95

Contains: "Logic, Discovery, and the Foundations of Computing Machinery" by M. E. Maron, "System Design of the Seac and Dyseac", by A. L. Leiner, and others; five more papers; and seven pages of reviews.

University of Michigan's Willow Run Research Center, staff of / MIDAC Automatic Computer / Willow Run Research Center, Engineering Research Institute, University of Michigan, Ypsilanti, Mich. / 1954, Litho, 16 pp, free

Discusses: why build a high speed computer? what is Midac? how does Midac perform its computations? how is a problem solved on Midac? how does Midac differ from previous computers/ what are Midac specifications?

Association for Computing Machinery / Ann Arbor Meeting Program, June 23 to 25, 1954, at the University of Michigan, Ann Arbor, Mich. / Association for Computing Machinery, 2 East 63 St., New York 21, N. Y. / 1954, printed, 40 pp, distributed free to members and registrants

Contains the program of the meeting and abstracts of the 110 papers that were scheduled to be given. It is understood that the Association does not intend to reprint the abstracts in the "Journal of the Association for Computing Machinery".

Bar-Hillel, Yehoshua / "Can Translation be Mechanized?" in "The American Scientist", April 1954/ reprinted with permission by Research Laboratory of Electronics, Mass. Inst. of Technology, Cambridge 39, Mass. / 1954, printed, 13 pp, limited distribution

Discussion of the possibility of and techniques for mechanizing translation from one language to another. This discussion was apparently written before the IBM 701 actually translated from Russian to English.

Keller, Allen, and Richard A. Butterworth / Programming for the IBM 701 Electronic Data Processing Machine with Repetitively Used Functions / General Electric Co., Medium Steam Turbine, Generator, and Gear Dept., Lynn, Mass./ 1954, mimeographed, 32 pp, limited distribution

"For about two years the authors have been programming engineering calculations for a computer 1000 miles distant. A direct leased wire is available for transmitting punched card data and for communications. Most of the problems are repetitive .... Many of the super-programs consist largely of control instructions to direct the proper execution of suitable subprograms in the proper sequence. Liberal use is made of automatic programming techniques. ...This paper describes the methods used". These methods include a striking correspondence of analog nature between physical realities (pumps, condensers, heaters, boilers) and appropriate commands to the computer.

Stuart-Williams, Raymond, M. Rosenbert, and M. A. Alexander / Recent Advances in Coincident-Current Magnetic Memory Techniques / International Telemeter Corporation, 2000 Stoner Ave., Los Angeles 25, Calif. / 1954, lithographed, 13 pp, free

Report on the design of large high-speed random-access magnetic memories, using ferrite cores and coincident currents for reading and writing information. The memory may contain 33,000 bits or more. This is the published version of paper 76 given at the Ann Arbor meeting of the Association for Computing Machinery in June, 1954.

Burks, Arthur W., and Jesse B. Wright / "Theory of Logical Nets", reprinted from Proceedings of the IRE, vol. 41, no. 10, Oct. 1953 / The Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y. / 1954, printed, 9 pp, limited distribution

'The aim of this paper is to place on a more rigorous basis the application of two-valued logic to digital computing circuits. It studies the formal properties of various logical nets, some of which represent such circuits to a useful degree."

International Business Machines Corp. / Electronic Calculator Type 607, Principles of Operation, first revision, Form 22-6064-1 / International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. / 1954, printed, 86 pp, limited distribution

Covers operating principles, crossfooting, multiplication, group multiplication, division, successive calculation, checking, simultaneous operations, payroll calculations, square root, &c.

International Business Machines Corp. / Type 650 Operating Principles, Preliminary Edition, Form 22-6149-0 / International Business Machines Corp., 590 Madison Ave., New York 22, NN. Y. / 1953, photooffset, 59 pp, limited distribution

Covers operating principles, codes, multiplication, division, lookup, distribution, checking, optimum programming, &c. This is mainly for persons primarily interested in commercial applications.

Forbes, George F. / Digital Differential Analyzers, Monographs Nos. 5 and 6 / G. F. Forbes, 10117 Bartee Ave., Pacoima, Calif. / Feb. and Apr., 1954, dittoed, 29 pp, fifth and sixth parts 32 pp, $1.00

See entry in "Books and Other Publications" in "Computers and Automation" for March, 1954.

Weiss, E. B. / "Cybernetics, Automation, &c.", Series of 4 articles, in "Advertising Age", Oct. 5 to 26, 1953 / Advertising Age, 200 E. Illinois St., Chicago 11, Ill. / 1953, photooffset, 14 pp, 35¢

The use of cybernetics and automation in business, factory, warehouse, retail store, &c.; the influence of the development of automation principles on selling, merchandising, and advertising.

Schlang, Arthur / "A Digital Nim Computer" in "Radio-Electronics", vol. 25, no. 6, June, 1954 / Gernsback Publications, Inc., 25 West Broadway, New York 7, N. Y. / 1954, printed, 2 pp, 35¢

Describes a game, Nim, which can be played according to a mathematical system, and shows the mechanical computer developed to play Nim, giving the wiring diagram for the machine and a list of parts needed to build it.

Leiner, Alan L. / System Organization of the Dyseac, NBS Report 2893 / National Bureau of Standards, Electronic Computers Laboratory, Washington 25, D. C. / Aug., 1953, photooffset, 59 pp, cost ?

Describes the system features, over-all functional organization, and operating capabilities of Dyseac, with tables and diagrams. The Dyseac is a complete general-purpose high-speed digital computer, using the same electronic building blocks as Seac, but more adapted to control and respond to auxiliary external devices.

Holmes, Thomas G., and Harlan F. Manweiler/Florida Automatic Computer / Computer Engineering Branch, Technical Systems Laboratory, Air Force Missile Test Center, Patrick Air Force Base, Florida / Sept. 22, 1953, photooffset, 7 pp, cost ?

Brief description of the design and operation of FLAC, a high-speed large-scale digital computer. Includes a list of "FLAC Operating Characteristics" and a

drawing of the completed FLAC computing facility.

Leiner, A. L., W. A. Notz, J. L. Smith, and A. Weinberger / System Design of the SEAC and DYSEAC, NBS Report 2922 / National Bureau of Standards, Electronic Computers Laboratory, Washington 25, D. C. / Aug., 1953, photoffset, 30 pp, cost ?
Report discusses some of the factors which governed the choice of system features in the automatic computers SEAC and DYSEAC. Describes some of the standard procedures which were developed for working out their system designs. Includes tables and diagrams.

Logistics Research, Inc. / Alwac -- General Purpose Computer / Logistics Research, Inc., Redondo Beach, Calif. / 1954(?), photooffset, 40 pp, free
Describes ALWAC, a general-purpose automatic digital computer and its memory capacity, computing speed, reliability, input, output, physical specifications, instruction code, and operation.

Remington Rand, Inc. / "The Programmer", vol. 1, no. 4, June-July, 1954 / Remington Rand, Inc., Electronic Computer Dept., 315 Fourth Ave., New York 10, N. Y. / 1954, printed bimonthly, 4 pp, free
Contains reports on: a new card-to-magnetic-tape converter; "simplex" mathematical routines in optimum scheduling; tables for estimating time on Univac for certain purposes; &c.

Meier, Richard L. / "Automatic and Economic Development" in "Bulletin of the Atomic Scientists", vol. x, no. 4, April, 1954 / Univ. of Chicago Press, 5750 Ellis Ave., Chicago 37, Ill./ 1954, printed, pp 129-133, $.50
A discussion of fully automatic production units in underdeveloped economic areas.

The Office, staff of / "Integrating the Office for Automation" in "The Office", vol. 39, no.4, April, 1954 / Office Publications Co., 270 Madison Ave., New York 16, N. Y. / 1954, printed, pp 66-80 ... $2.00 a year, cost this issue ?
Reports of talks by H. F. van Gordon and others on integrated data processing -- the papers given at the American Management Association Conference in New York, in February, 1954.

Locke, W. N., and V. H. Yngve / MT, Mechanical Translation, vol. 1, no. 1, March, 1954 / Massachusetts Institute of Technology, Dept. of Modern Languages, Cambridge 39, Mass. / 1954, photooffset, 10 pp, limited distribution
Bibliography and abstracts of papers on the translation of languages with the aid of machines; entries are arranged in approximate chronological order, and designed so they can be clipped and fastened to 3 x 5 cards for filing.

Flight Simulator Associates / "Simulore", Issue 9, May, 1954 / Flight Simulator Associates, Box 100, Tyndall AFB, Florida / 1954, photooffset, 10 pp, $.50
Contains short reports: "Reference Signal Plus or Minus Phase Balance Error"; "Teaching vs. Learning"; "Low Voltage-High Hazards"; "Training Aids Phasing Group"; &c.

Locke, W. N., and V. H. Yngve / Mechanical Translation, vol. I, no. 2, August, 1954 / Mass. Inst. of Technology, Dept. of Modern Languages, Cambridge 39, Mass. / 1954, photooffset, 17 pp, free
Contains: a page of news; two articles "The Machine and Man the Man" by V. H. Yngve, and "Report on the First Conference on Mechanical Translation" by Erwin Reifler; brief reports on 14 items of research in progress; and five bibliographical items.

Cross, Ralph E. / "Trends in Machine-tool Automation" in "Instruments and Automation", vol. 27, no. 5, May, 1954 / Instruments Publishing Co., 845 Ridge Avenue, Pittsburgh 12, Pa./ 1954, printed, 161 pp, 768-770, $4.00 a year, single issue ?
The development of machine-tool automation: single-station machines; multiple-station machines; transfer machines; "automatic tool programming", to attack the problem of down time because of tool changing; and a (proposed) automatic work-banking unit. An excellent, clear article.

Walter, W. Grey / "The Electrical Activity of the Brain" in "Scientific American", vol. 190, no. 6, June, 1954 / Scientific American, 2 West 45 St., New York 36, N. Y. / 1954, printed, pp 54-63, 50¢
Describes a new method of recording the pulsation of tiny currents from various parts of the head. Thus the electrocephalographer may diagnose brain disorders, and examine the electrical behavior of the mind, still without a theory that explains it.

- END -

ROBOTS I HAVE KNOWN
(continued from page 23)

and in the child's reaction to that.

My latest robot story, a full-length novel entitled "The Caves of Steel" (1954), peers further into the future, and is laid in a time when other planets, populated by emigrating Earthmen, have adopted a thoroughly robotized economy, but where Earth itself, for economic and emotional reasons, still objects to the introduction of the metal creatures. A murder is committed, with robot-hatred as the motive. It is solved by a pair of detectives, one a man, one a robot, with a great portion of the deductive reasoning (to which detective stories are prone) revolving about the Three Laws and their implications.

In fourteen years; I have managed to convince myself that the Three Laws are both necessary and sufficient for human safety in regard to robots. It is my sincere belief that some day when advanced human-like robots are indeed built, something very like the Three Laws will be built into them. I would enjoy being a prophet in this respect, and I regret only the fact that the matter probably cannot be arranged in my lifetime.

- END -

PATENTS

Hans Schroeder
Milwaukee, Wisconsin

The following is a compilation of patents pertaining to computers and associated equipment from the Official Gazette of the United States Patent Office, dates of issue as indicated. Each entry consists of: patent number/ inventor(s) / assignee / invention.

July 20, 1954: 2,684,440 / H S Wallace, Arlington Heights, Ill, and A P Tullener s, Gillet, Wis / Zenith Radio Corp / Pulse-controlled bistable multivibrator using a single triode in connection with a glow discharge tube

2,684,443 / F E Tidball, Minneapolis, Minn / USA, Sec'y of the Navy / Circuit for comparing synchronism of two AC voltages with slightly different frequencies

July 27, 1954: 2,685,039 / A D Scarbrough, Pasadena, and E E Bolles, Los Angeles, Calif/ Hughes Aircraft Co / Diode gating circuits

2,685,049 / R K Steinberg, Poughkeepsie, NY/ Intl Business Machines Corp, New York, N Y/ Coincidence circuit using gaseous discharge tubes with several anodes

2,685,054 / M M Brenner and S.S Appleton, Belmar, B Lippel, Redbank, and D H Hamsher, Long Branch, N J / USA, Sec'y of the Navy / System for converting electrical code into shaft rotation

2,685,067 / H N Beveridge, Arlington, and J J Staller, Roxbury, Mass / Raytheon Mfg Co, Newton, Mass / Delay line using multiple reflection of sound waves in a mercury-filled container

2,685,084 / B Lippel and J A Buegler, Red Bank, N J / USA, Sec'y of the Army / Decoder for digital code group signals

August 3, 1954 -- Issue not yet received

August 10, 1954: 2,686,008 / W C Davidson, Chicago Heights, Ill / Nuclear Instrument and Chemical Corp / Pulse counting apparatus

2,686,100 / J P Eckert, Jr, J C Sims, Jr, and H F Welsh, Phila, Pa / Remington Rand, Inc, New York, N Y / Multiple head magnetic tape recorder for recording pulses

2,686,222 / D F Walker, Edinburgh, Scotland, and M K Taylor, Downsview, Ont, Canada / Ferranti Ltd, Hollinwood, Eng / Binary digit storage device

2,686,273 / G H Hough and T M Jackson, London, Eng / Intl Standard Electric Corp, New York, N Y / Gaseous discharge tube with multiple cathodes for scaling

2,686,282 / G M Salamonovich, Hollywood, Cal-

(continued on page 34)

Digital Computer Techniques

Applied to the design, development and application of

Electronic Business Systems
Military Radar Fire Control Systems
Aircraft Control and Navigation Systems

The successful application of Hughes airborne digital computers to high speed aircraft fire control problems has opened up an entire new area for these digital computer techniques. Similar equipment is now under development in the Advanced Electronics Laboratory to apply such digital computer systems to modern business information handling.

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PROGRAMMING
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Scientific and Engineering Staff

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

Forum

THE CAPACITY OF COMPUTERS NOT TO THINK

I. From Irving Rosenthal, New York:

To the Editor:

I have been distressed by the tenor of some of the discussions and articles which you have published from time to time on the question of the capacity of electronic computers of the present or future to think. I feel that on the whole these discussions have contributed very little to scientific clarity.

Many of your readers, judging from my conversation with some of them, don't take these discussions very seriously. The typical reaction is that it is all a matter of definition. Define thinking one way and you may say that the electronic computer can think. Define it another way and you would have to deny that capacity.

I don't think the matter should be disposed of so easily. Thinking is one of the unique features of human life. To allow thinking to be defined so that it is robbed of its element of human creativity is not only scientifically harmful but it is damaging to our sense of human dignity. And it is also politically damaging to our country.

Part of the process of education is to assign to students the job of working out solutions to problems whose methods of solution and actual results are already known to the teachers. This is a valuable voyage of discovery for the student but it adds nothing to the body of science and nothing to the collection of practical useful facts which society knows.

On a somewhat higher level is the job of working out solutions to problems where the exact solution is not yet known but where it is known that a solution exists and where, moreover, the general method of solution is known. Such exact solutions, often involving much arduous labor by other techniques, may be obtained expeditiously by the use of electronic computers.

To obtain the exact solution we feed into the computer the network of premises and given data and a set of instructions comprising the method of solution, and -- presto! the labor of 10,000 human hours is done in an electronic instant. This quick working out of exact solutions to problems whose basis and structure of solution is known is of very great practical value to society. But it also adds nothing to the body of science and to the conceptual scope of human life.

Neither of these two types of "solution-workout" has any element of human creative thinking. Applied to the simplest "as-yet-unsolved" problem of science, business or practical life, these approaches would be completely ineffective. For the way the "as-yet-unsolved" problem is finally solved is through a complex process which involves discontinuities and contradictions and the desires of human beings to eliminate these discontinuities and contradictions. More specifically the process of solution or discovery involves the following steps:

1. An illegitimate "jump to conclusion", a guess, a flash of intuition, i.e., a conclusion which is not logically justified by the premises and facts which have been accepted up to that point. Initially the conclusion jumped to may have more passion than logic behind it.

2. A recognition that a logical discontinuity or contradiction exists between the conclusion the heart desires, or the facts dictate, and the premises and facts so far accepted.

3. A critical re-examination of the premises and facts looking toward a revision or revaluation which would make them compatible with the desired conclusions.

4. A series of stage-by-stage modifications of both premises and conclusions as the thinker struggles to make them logically compatible with each other and yet preserve agreement of both with the relevant empirical evidence. Connected with this there is a continuous re-evaluation and re-examination of the empirical evidence with respect to the issue of relevancy.

It is evident first of all that the process of creative thinking involves a temporary toleration of logical discontinuities and contradictions which violates all principles of machine design. Second, it involves a determined effort to get rid of these discontinuities and contradictions. It is clear therefore that human emotional interest and energy is required, that without passion and will the painful difficulties of creative thinking could not be overcome.

There used to be a perfectly respectable philosophical word available to describe the two-sided process of modification of premises and conclusions involved in creative thinking. This word was "dialectical", a word of Greek origin meaning discourse or discussion and first applied by the German philosopher Hegel to characterize the process of development

through the synthesis of opposite tendencies. Applied to the process of creative thinking, it would signify the progressive modification of both premises and conclusions as the contradictory implications of an incompatible set were exposed and efforts made to overcome them. The Socratic dialogues of Plato furnish examples of the dialectic process in both the Greek and Hegelian senses.

Hegel's philosophy is now more or less tabu in American intellectual life. It is regarded with hostility on several counts. Some parts of this philosophy have been incorporated into Marxism, the official philosophy of world communism so that it suffers "guilt by association". The philosophy of Hitler and other fascists also showed signs of Hegelian influence. Finally, Hegel's dialectic is widely, though perhaps mistakenly, regarded as involving an attack on the validity of formal logic, as denying the principles of identity and excluded middle. Be that as it may, one doesn't have to become a dues-paying Hegelian to recognize the specific quality of creative thinking, which is its non-mechanical character.

And now I am led to my final observation. The Soviet propaganda mill, if it ground up the past discussions on the capacity of machines to think which have appeared in these pages, could well make something like this out of them with no more than the usual amount of deliberate distortion:

"A cloud of intellectual sloth and conformity has descended upon American life. Americans have come to believe that all thinking is a mere mechanical forward march, goose-step fashion, from premises to conclusion. Why then take time off from the joys of television, horror comics and highway homicide when machines can be devised to do all their thinking for them? It is also evident that Americans have lost their capacity to examine critically the accepted premises of their thinking, and that in fact, they no longer regard the process of thinking as necessarily involving a criticism of basic premises. If space permitted we could cite chapter and verse proving this from the leading American journal dealing with the subject of electronic brains, 'Computers and Automation'. This is a magazine which evidently caters to the deep desires of the American people to find solutions to all their problems by means of their favorite push-button methods and without further torture of their all-too-human aching brains."

This seems to be a pretty fair imitation of a type of cultural implement of war used with a great effectiveness in all countries of the world against the prestige of the United States.

I think it would be fair to say that your magazine has done its share to lend substance to this hypothetical caricature by its generally mechanistic treatment of the problem of thinking.

II. By John H. Troll, in "The Thinking of Men and Machines" in "The Atlantic", July, 1954, quoted with permission:

The uneasy half embarrased rivalry between man and machine has reached a peak with the thinking machine. We have become used to machines that are more powerful, more durable, more accurate, and faster than we are, but machines that challenge our intelligence are hard to take. At this point the competition becomes uncomfortable.

Machines and tools have always been created in the image of man. ....

But the newest machines possess human traits that had always been considered far beyond mechanization. Here we find not only electric eyes that see and sensing devices that feel, but also memories that recall and logic sections that classify, arrange, and select. These machines can make choices, comparisons, and decisions, learn from past experience, and reach logical conclusions on the basis of premises. It may no longer be denied: these machines can really think.

This realization has renewed the furtive rivalry between man and machine. ....

When Univac, one of the computers used on election night, made an amazingly accurate prediction of the outcome on the basis of very early returns, it was disbelieved by the experts who designed and constructed it. Even when by all rational standards it becomes evident that the machine knows better, man is reluctant to let it have the last word. ...

Can we call such a process thinking? We have seen that it involves remembering, sorting, classifying and choosing alternatives on the basis of logic. When men do this sort of work, it has always been called thinking. And so in fairness to the machine we must concede that within the usual meaning of the word it can and does think. And since in the course of its work, the machine discards solutions in favor of better ones, acting on past experience, it cannot be denied that it also learns. Since it thinks fast, it learns fast — much faster than a man. ....

(See the original article; it is well worth reading. -- Any more discussion? -- Edit.)

- END -

COMPUTERS AND AUTOMATION - Back Copies & Reprints

ARTICLES: January, 1953: Brains: Electronic and Otherwise -- A. S. Householder
What Computers Do -- S. B. Williams
The Parameters of a Business Problem in Reading -- C. H. Dent
Automatic Computers on Election Night -- E. F. Murphy and E. C. Berkeley
March: Gypsy, Model VI, Claude Shannon, Nimwit, and the Mouse -- George A. W. Boehm,
Water and Computers -- Henry M. Paynter, Jr., Mass. Inst. of Technology, and Neil Macdonald
The Concept of Automation -- E. C. Berkeley
The ERA 1103 Automatic Computer -- Neil Macdonald
April: The Art of Solving Secret Ciphers, and the Digital Computer -- Fletcher Pratt
Avenues for Future Development in Computing Machinery -- Edmund C. Berkeley
Hungarian Prelude to Automation -- Gene J. Hegedus
May: Compiling Routines -- Grace M. Hopper, Remington Rand
Mechanical Translation -- Andrew D. Booth, Birkbeck College, London
Medical Diagnosis -- Marshall Stone, University of Chicago
July: Machine Translation -- Y. Bar-Hillel, Mass. Inst. of Technology
Robot Traffic Policemen -- George A. W. Boehm,
How to Talk About Computers -- Rudolf Flesch, Author of "Art of Plain Talk"
September: The Soviet Union: Automatic Digital Computer Research -- Tommaso Fortuna
Digital Computer Questionnaire -- Lawrence Wainwright
"How to Talk About Computers": Discussion -- G. G. Hawley and others
October: Computers in the Factory -- David W. Brown
The Flood of Automatic Computers -- Neil Macdonald
The Meeting of the Association for Computing Machinery in Cambridge, Mass., September, 1953 -- E. C. Berkeley
November: Who Will Man the New Digital Computers? -- John W. Carr III
Electronic Equipment Applied to Periodic Billing -- E. F. Cooley
Air-Floating: A New Principle in Magnetic Recording of Information -- Glenn E. Hagen
December: How a Central Computing Laboratory Can Help Industry -- Richard F. Clippinger
"Combined" Operations in a Life Insurance Company Instead of "Fractured" Operations -- R. T. Wiseman
"Can Machines Think?": Discussion -- J.L. Rogers and A. S. Householder
January, 1954: The End of an Epoch: The Joint Computer Conference, Washington, D. C., December, 1953 -- Alston S. Householder
Savings and Mortgage Division, American Bankers Association: Report of the Committee on Electronics, September, 1953 -- Joseph E. Perry and others
Automation in the Kitchen -- Fletcher Pratt
February: Language Translation by Machine: A Report of the First Successful Trial -- Neil Macdonald
Reflective Thinking in Machines -- Elliot L. Gruenberg
Glossary of Terms in Computers and Automation: Discussion -- Alston S. Householder and E.C. Berkeley
March: Towards More Automation in Petroleum Industries -- Sybil M. Rock
Introducing Computers to Beginners -- Geoffrey Ashe
Subroutines: Prefabricated Blocks for Building -- Margaret H. Harper
Glossaries of Terms: More Discussion -- Nathaniel Rochester, Willis H. Ware, Grace M. Hopper and others
April: Processing Information Using a Common Machine Language: The American Management Association Conference, February, 1954 -- Neil Macdonald
The Concept of Thinking -- Elliot L. Gruenberg
General Purpose Robots -- Lawrence M. Clark
May: Ferrite Memory Devices -- Ephraim Gelbard and William Olander
Flight Simulators -- Alfred Pfanstiehl
Autonomy and Self Repair for Computers -- Elliot L. Gruenberg
A Glossary of Computer Terminology -- Grace M. Hopper
July: Human Factors in the Design of Electronic Computers -- John Bridgewater
What is a Computer? -- Neil Macdonald
September: Computer Failures -- Automatic Internal Diagnosis (AID) -- Neil Macdonald
The Cost of Programming and Coding -- C. C. Gotlieb
The Development and Use of Automation by Ford Motor Co. -- News Dept., Ford Motor Co.
Reciprocals -- A. D. Booth

REFERENCE INFORMATION (in various issues):

Roster of Organizations in the Field of Computers and Automation / Roster of Automatic Computing Services / Roster of Organizations Making Components / Roster of Magazines Related to Computers and Automation / List of Automatic Computers / Who's Who in the Field of Computers and Automation / Automation -- List of Outstanding Examples / Books and Other Publications / Glossary / Patents

Price of back copies, if available, $1.25 each.

A subscription (see rates on page 4) may be specified to begin with any issue from Sept., 1954, to date.

REPRINTS: Index No. 1 (from December, 1953, issue) -- 20 cents
Glossary of Terms in the Field of Computers nd Automation (from three 1953 issues) -- 60 cents

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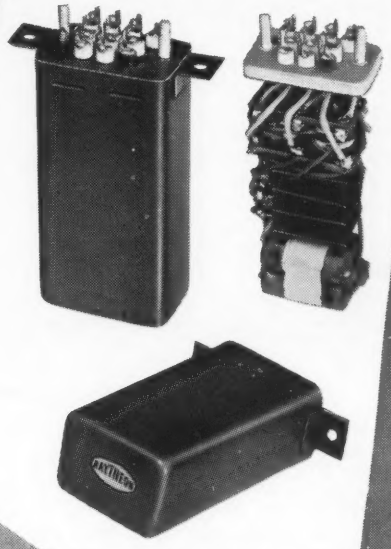

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Memorandum from Edmund C. Berkeley and Associates
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1. What is "COMPUTERS AND AUTOMATION"? It is a monthly magazine containing articles and reference information related to computing machinery, robots, automatic controllers, cybernetics, automation, etc. One important piece of reference information published is the "Roster of Organizations in the Field of Computers and Automation". The basic subscription rate is $4.50 a year in the United States. Single copies are $1.25. The magazine was published monthly except June and August between March, 1953, and September, 1954; prior to March 1953 it was called "The Computing Machinery Field" and published less often than ten times a year.

2. What is the circulation? The circulation includes 1200 subscribers (as of Aug. 3); over 300 purchasers of individual back copies; and an estimated 1500 nonsubscribing readers. The logical readers of COMPUTERS AND AUTOMATION are some 3500 or 4000 people concerned with the field of computers and automation. These include a great number of people who will make recommendations to their organizations about purchasing computing machinery, similar machinery, and components, and whose decisions may involve very substantial figures. The print order for the July issue was 1800 copies. The overrun is largely held for eventual sale as back copies, and in the case of several issues the overrun has been exhausted through such sale. A mailing to some 2000 nonsubscribers in December, 1953 (with 173 responses up to March, 1954) indicated that two-thirds of them saw the magazine (library, circulation, or friend's copy) and of these two-thirds over 93% "liked it".

3. What type of advertising does COMPUTERS AND AUTOMATION take? The purpose of the magazine is to be factual and to the point. For this purpose the kind of advertising wanted is the kind that answers questions factually. We recommend for the audience that we reach, that advertising be factual, useful, interesting, understandable, and new from issue to issue.

4. What are the specifications and cost of advertising? COMPUTERS AND AUTOMATION is published on pages 8½" x 11" (ad size, 7"x10") and produced by photooffset, except that printed sheet advertising may be inserted and bound in with the magazine in most cases. The closing date for any issue is approximately the 10th of the month preceding. If possible, the company advertising should produce final copy. For photooffset, the copy should be exactly as desired, actual size, and assembled, and may include typing, writing, line drawing, printing, screened half tones, and any other copy that may be put under the photooffset camera without further preparation. Unscreened photographic prints and any other copy requiring additional preparation for photooffset should be furnished separately; it will be prepared, finished, and charged to the advertiser at small additional costs. In the case of printed inserts, a sufficient quantity for the issue should be shipped to our printer, address on request.

Display advertising is sold in units of full pages (ad size 7" by 10", basic rate, $130) and half pages (basic rate, $70); back cover, $250; inside front or back cover, $160. Extra for color red (full pages only and only in certain positions), 35%. Two-page printed insert (one sheet), $220; four-page printed insert (two sheets), $400. Classified advertising is sold by the word (40 cents a word) with a minimum of ten words. We reserve the right not to accept advertising that does not meet our standards.

5. Who are our advertisers? Our advertisers in recent issues have included the following companies, among others:

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( ) Applications
( ) Sales
( ) Electronics
( ) Mathematics
( ) Business
( ) Programming
( ) Other (specify):
.....
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College or last school?.....

Year of entering the computing machinery field?.....

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READER'S INQUIRY FORM

Please send me additional information on the following subjects for which I have circled the CA number:

| | | |

ADVERTISING INDEX – OCTOBER 1954

The purpose of COMPUTERS AND AUTOMATION is to be factual, useful, and understandable. For this purpose, the kind of advertising we desire to publish is the kind that answers questions, such as, What are your products? What are your services? And for each product, What is it called? What does it do? How well does it work? What are its main specifications? We reserve the right not to accept advertising that does not meet our standards.

Following is the index and summary of advertisements. Each item contains: name and address of the advertiser / subject of the advertisement / page number where it appears / CA number in case of inquiry (see note below).

Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y. / Data Recording Tape / page 35 / CA No. 80

Automatic Electric Co., 1033 West Van Buren St., Chicago, Ill. / Relays / page 5 / CA No. 81

Computers and Automation, 36 West 11th St., New York 11, N. Y. / Back Copies, Advertising, Reply Form / pages 30, 32, 33 / CA No. 82

Edmund C. Berkeley & Associates, 36 West 11th St., New York 11, N. Y. / Publications / page 31 / CA No. 83

Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y. / Ferranti High Speed Tape Reader / page 35 / CA No. 84

Ferroxcube Corp. of America, East Bridge St., Saugerties, N. Y. / Magnetic Core Materials: Ferrites / page 33 / CA No. 85

Hughes Research and Development Laboratories, Culver City, Calif. / Digital Computer Techniques / page 27 / CA No. 86

Ketay Manufacturing Co., 555 Broadway, New York 12, N. Y. / Ketay Products / pages 18, 19 / CA No. 87

Lockheed Aircraft Corp., Burbank, Calif. / Career Opportunities / page 2 / CA No. 88

Monrobot Corporation, Morris Plains, N. J. / Monrobot Computer / page 20 / CA No. 89

Raytheon Mfg. Co., Foundry Ave., Waltham, Mass./ Magnetic Shift Register / page 31 / CA No. 90

Remington Rand, Inc., 315 4th Ave., New York 10, N. Y. / Univac / page 17 / CA No. 91

Sprague Electric Co., 377 Marshall St., North Adams, Mass. / Tantalex Capacitors / page 36, back cover / CA No. 92

If you wish more information about any of the products or services mentioned in one or more of these advertisements, you may circle the appropriate CA No.'s on the Reader's Inquiry Form (see page 32) and send that form to us (we pay postage; see the instructions). We shall then forward your inquiries, and you will hear from the advertisers direct.

- END -

PATENTS
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if / North Amer Aviation, Inc / Shaft rotation function generator using motion picture film on which function has been recorded

August 17, 1954: 2,686,632 / J H Wilkinson, Teddington, Eng / Natl Research Development Corp, London, Eng / Binary multiplier

2,686,634 / E Kolisch, New York, N Y / Continental Silver Co, Inc, Brooklyn, N Y / Analog computer for determining economical and safe loading of aircraft

2,686,635 / A A Markson, Mount Lebanon Twp, Allegheny Co, Pa / Hagan Corp, Pittsburgh, Pa / Electromagnetic ratio computing device

2,686,636 / E Lakatos, Cranford, and H G Och, Short Hills, N J / Bell Tel Labs, Inc, New York, N Y / Computer for predicting the (curved) course of a body, based on previous observation

- END -